

TOYOTA

18R ENGINE

REPAIR MANUAL

INCLUDES

18R, 18R-C & 18R-G



TOYOTA MOTOR SALES CO., LTD.

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FOREWORD

This manual describes the repair procedures for the 18R, 18R-C & 18R-G engines equipped on the TOYOTA CELICA, CORONA, CRESSIDA, HI-LUX, and HI-ACE.

Under DISASSEMBLY and ASSEMBLY, you will find disassembled views which carry numbers indicating the sequence of operation procedure. The operations can be accomplished by following these numbers. To facilitate understanding, there are also some figure numbers after operation numbers showing the locations of work details. The texts have different symbol marks which supersede the figure explanation.

This manual provides complete information on the maintenance and service of those engines, and it is hoped that it will see much use.

All information contained in this manual is the most up-to-date at the time of publication, and we reserve the right to make any changes without further notice.

For service of emission control devices, refer to each emission control repair manual.

For new service specification data, refer to service specification manuals.

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GENERAL

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GENERAL REPAIR INSTRUCTION

1. Use fender, seat, and floor covers to keep the car clean and prevent damage.
2. During disassembly, keep parts in order for reassembly.
3. Before performing electrical work, disconnect the cable to the positive (+) battery terminal.
4. Always replace gaskets and O-rings with new ones.
5. Always use sealer on gaskets to prevent leaks.
6. Carefully observe all specifications for bolt torques. Always use a torque wrench.
7. Use genuine Toyota parts.
8. If the vehicle is to be jacked up only at the front or rear end, be sure to block the wheels in order to ensure safety.
9. After the vehicle is jacked up, do not fail to support it on stands. It is extremely dangerous to do any work on the vehicle raised on jack alone, even for a small job that can be finished quickly.
10. Use of a special service tool (SST) may be required, depending on the nature of the repair. Be sure to use SST where specified and follow the proper work procedure. A list of the SST is found at the back of this manual.

ABBREVIATIONS USED IN THIS MANUAL

For convenience, the following codes are used in this manual.

| Abbreviation | Term | Definition |
|--------------|-------------------------------------|--|
| SST | Special Service Tool | This term designates tools that have been manufactured specially for the servicing of this vehicle. Their part numbers are shown in the text enclosed by []. |
| STD | Standard | This term refers to the dimension of the part when originally manufactured. |
| O/S | Oversize | Sizes larger than STD are indicated as O/S. |
| U/S | Undersize | Sizes smaller than STD are indicated as U/S. |
| MP | Multipurpose | Use in the case of MP grease. |
| BTDC | Before Top Dead Center | |
| T/M | Transmission | |
| TVSV | Thermostatic Vacuum Switching Valve | |
| AAP | Auxiliary Acceleration Pump | |

SYMBOL MARK

The following symbols have been adapted for simplicity and for easy comprehension.



ASSEMBLE



DISASSEMBLE



INSTALL



REMOVE



INSPECT



MEASURE



TIGHTEN



CLEAN



IMPORTANT

18R ENGINE TUNE-UP

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18R ENGINE TUNE-UP ITEM

| ITEM | | REMARK |
|------|-----------------------------|----------------------------------|
| 1 | ENGINE OIL | |
| | Oil level check | "Full" line |
| | Oil replenishment | API service SE classification |
| | Oil capacity | |
| | RT Total | 5.0 liter 5.3 US qt. 4.4 Imp.qt. |
| | Crankcase | 3.8 liter 4.0 US qt. 3.3 Imp.qt. |
| | RA Total | 4.7 liter 5.0 US qt. 4.1 Imp.qt. |
| | Crankcase | 3.8 liter 4.0 US qt. 3.3 Imp.qt. |
| | RX Total | 5.0 liter 5.3 US qt. 4.4 Imp.qt. |
| | Crankcase | 3.9 liter 4.1 US qt. 3.4 Imp.qt. |
| | RN Total | 5.0 liter 5.3 US qt. 4.4 Imp.qt. |
| | Crankcase | 4.1 liter 4.3 US qt. 3.6 Imp.qt. |
| | Quality check | |
| | Oil filter replacement | SST [09228-44010] |
| 2 | COOLING SYSTEM | |
| | Coolant level check | "Full" line |
| | Quality check | |
| 3 | DRIVE BELT | |
| | Coolant capacity (w/heater) | 8.0 liter 8.5 US qt. 7.0 Imp.qt. |
| | Tension Fan — Alternator | 8 — 12 mm 0.35 — 0.47 in |
| 4 | AIR CLEANER | |
| | A/C Compressor — | |
| | Crankshaft | 15 — 18 mm 0.59 — 0.71 in |
| 5 | BATTERY | |
| | Element cleaning | |
| | Specific gravity | 1.25 — 1.27 at 20°C (68°F) |
| | Electrolyte level | |
| 6 | SPARK PLUG | |
| | Visual check | |
| | Cleaning | |
| 7 | HIGH TENSION CORD | |
| | Plug gap | 0.8 mm 0.03 in |
| | Resistance | Less than 25 k Ω per cord |
| 8 | DISTRIBUTOR | |
| | Distributor cap | |
| | Point gap | 0.45 mm |
| | Damping spring gap | 0.1 — 0.4 mm 0.004 — 0.168 in |
| | Dwell angle | 50 — 54° |
| | Dwell angle variation | within 3° |
| | Ignition timing | 7° BTDC/750 \pm 50 rpm |
| | Governor operational | |
| | Vacuum operational | |

| ITEM | | REMARKS |
|------|-----------------------|--|
| | WARM UP ENGINE | |
| 9 | VALVE CLEARANCE (HOT) | Intake 0.20 mm 0.008 in Exhaust 0.36 mm 0.014 in |
| 10 | CARBURETOR | Automatic check Check throttle valve full open Check the accelerating pump Float level |
| 11 | INITIAL IDLE SPEED | Idle speed 750 ± 50 rpm Manifold vacuum 420 mm Hg 16.5 in Hg |
| 12 | CO CONCENTRATION | 1-3 % |
| 13 | ENGINE CONDITION | |
| 14 | FAST IDLE | 2600 ± 200 rpm |
| 15 | COMPRESSION PRESSURE | Standard 12.0 kg/cm ² 170.4 psi Limit 9.0 kg/cm ² 127.8 psi Difference of pressure between cylinders Less than 1.0 kg/cm ² 14.2 psi |

Fig. 2-1

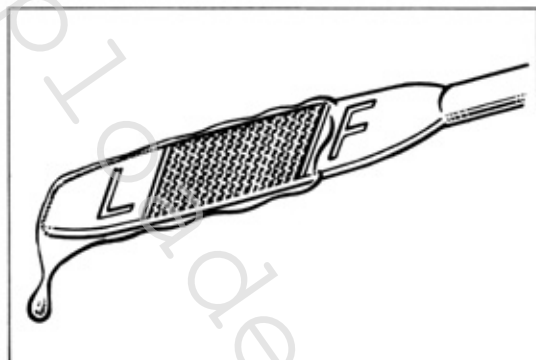


Fig. 2-2

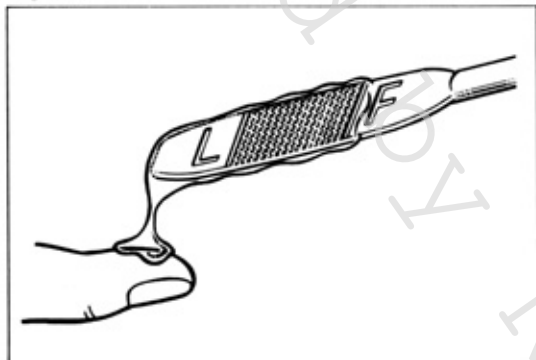


Fig. 2-3



Fig. 2-4



ENGINE OIL

LEVEL CHECK and REPLENISHMENT

Oil level should be up to the F line on the level gauge. If low, add oil up to the F line. Use API service SE classification engine oil.



QUALITY CHECK

Pull out the oil level gauge and examine the oil adhering on the graduated part. The oil should not be discolored or thin.



OIL FILTER REPLACEMENT

1. Remove the oil filter by using SST [09228-44010].
2. For installation, tighten firmly the oil filter by hand.



3. After starting the engine, check for oil leak and recheck the oil level.



Fig. 2-5



Fig. 2-6



Fig. 2-7

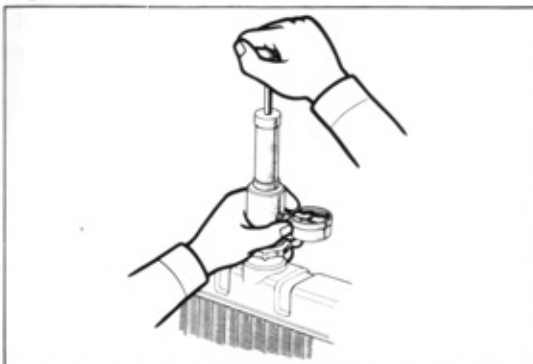
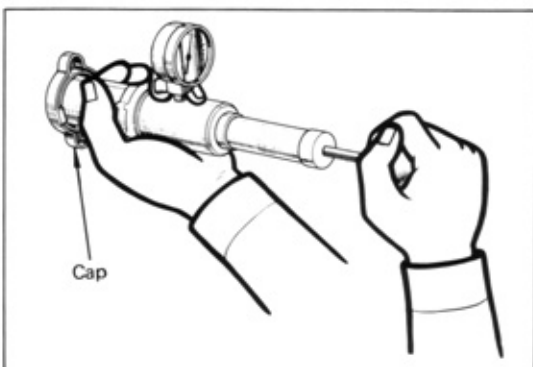


Fig. 2-8



COOLING SYSTEM

COOLANT LEVEL CHECK and REPLENISHMENT



If coolant is low, fill reservoir tank up to "Full" line.

COOLANT QUALITY CHECK



There should not be any excessive deposit of rust or scales around the radiator cap or radiator filler hole, and the coolant should also be free from oil. Replace the coolant if excessively dirty.

INSPECTION of COOLING SYSTEM PARTS



There should be no defects such as listed below:

1. Damage, deterioration, or loose clamps in radiator hoses, water hoses.
2. Leakage due to corrosion or damage in radiator core.
3. Leakage due to loose water drain cock.
4. Leakage from water pump.



5. Faulty operation of radiator cap.

Inspect the radiator cap pressure regulating and vacuum valves for spring tension and seating condition. If the valve opens at a pressure level below the specified value or is otherwise defective, replace the radiator cap.

Valve opening pressure limit

0.6 kg/cm² (8.5 psi)

Standard

0.9 kg/cm² (12.8 psi)

Fig. 2-9

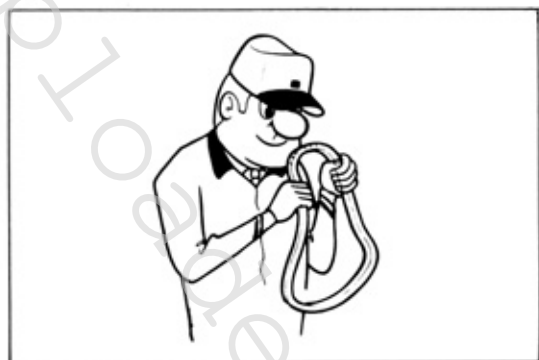


Fig. 2-10

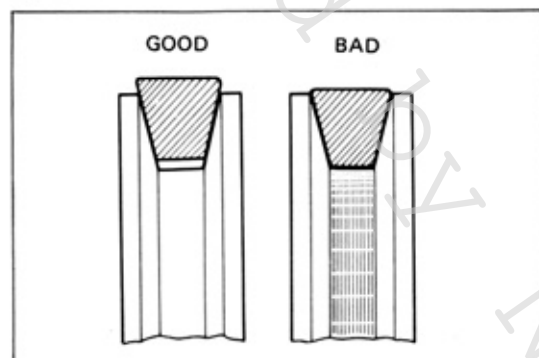


Fig. 2-11

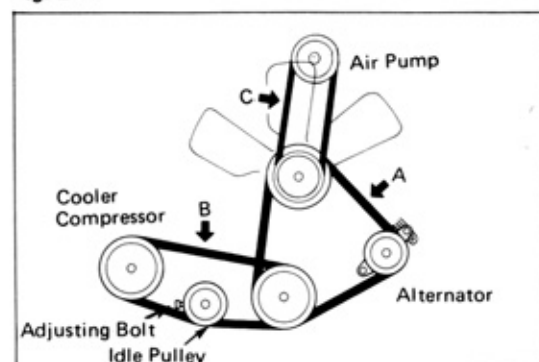


Fig. 2-12



DRIVE BELT VISUAL CHECK



There should be no defects such as listed below:

1. Cracked, deteriorated, stretched, or worn belt.
2. Adherence of oil or grease.



3. Improper contacting of belt against the pulley.

TENSION CHECK and ADJUSTMENT



When the belt is pressed down with 10 kg (22 lb) force, the belt should deflect the specified amount.

- A : 9 – 13 mm (0.35 – 0.51 in)
 B : 15 – 18 mm (0.59 – 0.71 in)
 C : 13 – 18 mm (0.51 – 0.71 in)

— Caution —

Do not pry aluminum body of air pump.

AIR CLEANER ELEMENT CLEANING



1. In removing the air cleaner or element, and after removal, use care not to drop dirt and dust down into the carburetor.
2. In cleaning the element, blow air from the inner side.
3. In case the element is torn or excessively dirty, replace with new one.

Fig. 2-13

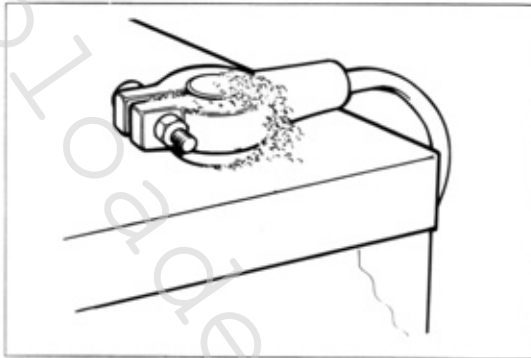


Fig. 2-14

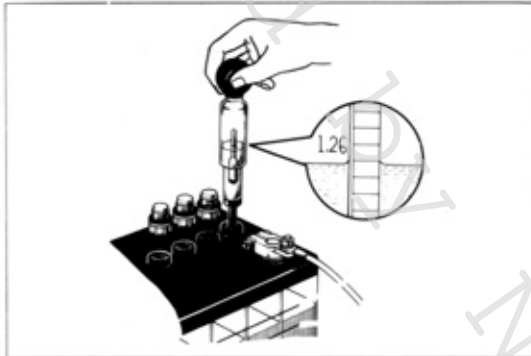


Fig. 2-15

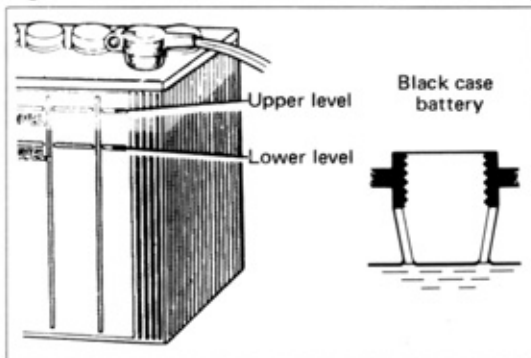
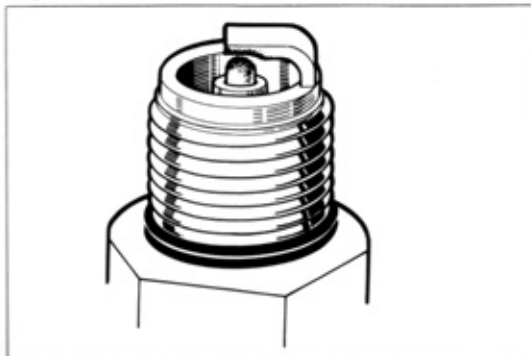


Fig. 2-16



BATTERY VISUAL CHECK



If very dirty, remove and clean before checking. There should be no defects such as listed below:

1. Rusted battery mounting hardware.
2. Damage or leakage in battery.
3. Loose connection, rusting, deterioration or corrosion of battery terminals.

SPECIFIC GRAVITY MEASUREMENT



Hold the hydrometer so that the float will not contact against the cylinder wall and read the graduation.

Specific gravity

1.25–1.27
at 20°C (68°F)

ELECTROLYTE LEVEL CHECK and REPLENISHMENT



The electrolyte level should be up to the upper level. If low, add distilled water (or purified water).

SPARK PLUG VISUAL CHECK



Condition is good if none of the following defects are present:

1. Cracks or damages in the threads or insulator.
2. Wear on the electrodes.
3. Damaged or deteriorated gaskets.
4. Burnt condition of electrode and undesirable carbon deposit.

Fig. 2-17

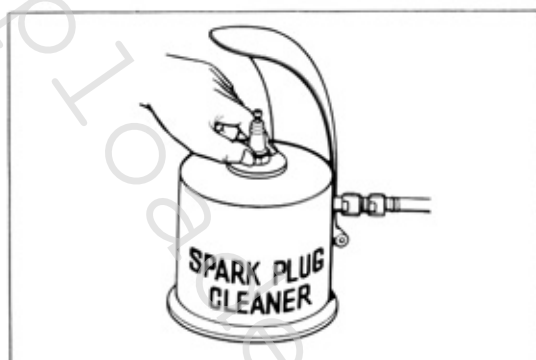


Fig. 2-18

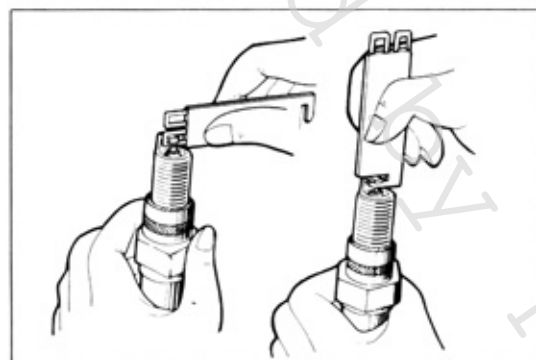


Fig. 2-19

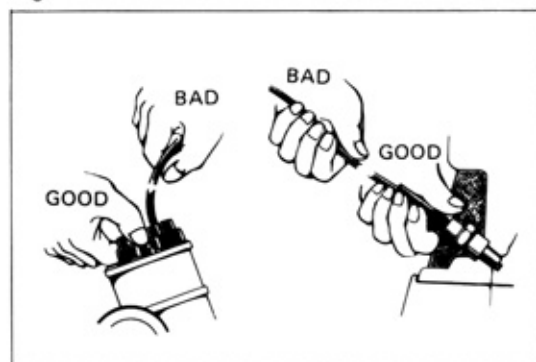
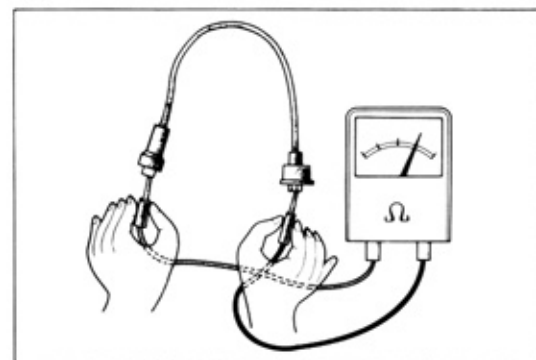


Fig. 2-20



CLEANING



1. Do not use spark plug cleaner longer than necessary.
2. Blow off cleaning compound and carbon on the threads thoroughly with air.
3. Clean off dirt from the outer surface of insulator and threads.

GAP ADJUSTMENT



Check the plug gap with plug gap gauge. If not to specified value, adjust by bending the ground (outer) electrode.

Plug gap 0.8 mm (0.031 in)

HIGH TENSION CORD



— Note —

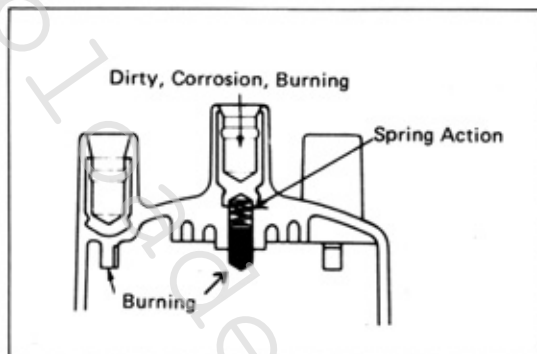
When pulling out the spark plug cord from the plug, always grip the end of plug cord.



Check the resistance of resistivity cord.

Resistance Less than 25 kΩ per cord.

Fig. 2-21

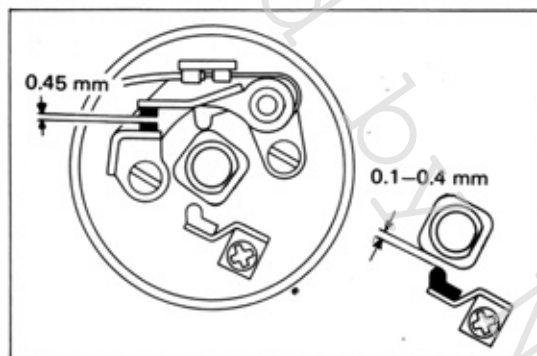


DISTRIBUTOR CAP INSPECTION

Clean the distributor cap and inspect the cap and rotor for:

1. Cracks, damage, dirty cord hole, corrosion, burning.
2. Center piece spring action.
3. Burnt electrode terminal.

Fig. 2-22



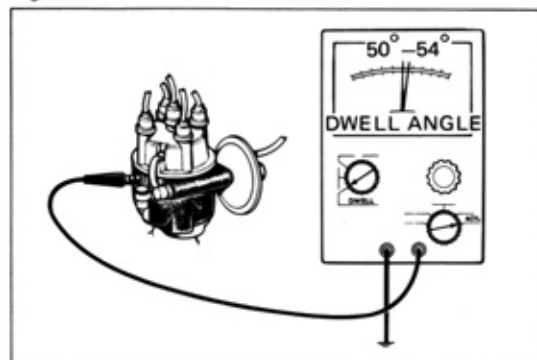
POINT GAP ADJUSTMENT

1. If the points are excessively burnt or pitted, replace the breaker points.
2. Adjust point gap and damping spring.

Point gap 0.45 mm (0.018 in)

Damping spring gap
0.1 – 0.4 mm
(0.004 – 0.168 in)

Fig. 2-23



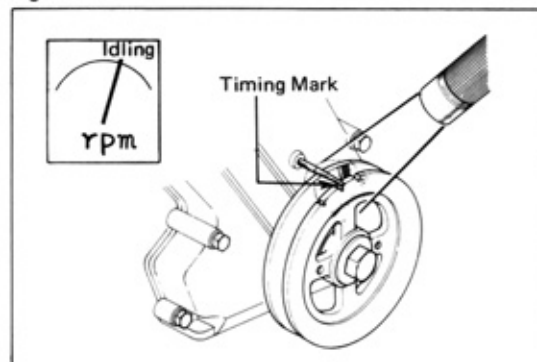
DWELL ANGLE

Check if dwell angle is within the specified value.

Dwell angle 50 – 54°

Variation
within 3° (at idling to 2000 rpm)

Fig. 2-24



IGNITION TIMING INSPECTION

Set the engine revolution at idle speed.

The octane selector must be set at standard position.

Ignition timing
7° BTDC/750 ± 50 rpm
(Red mark)

Fig. 2-25

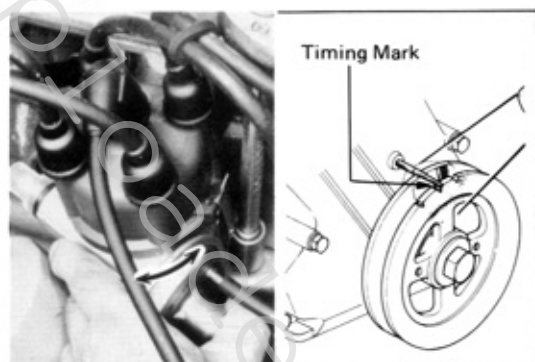


Fig. 2-26

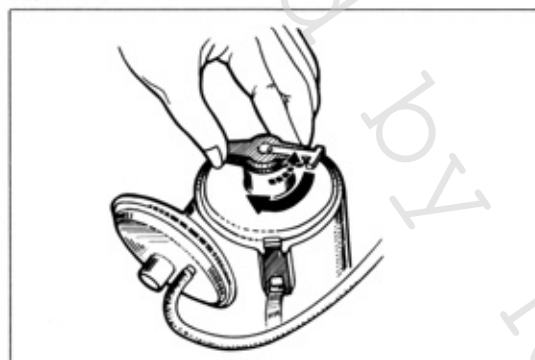


Fig. 2-27

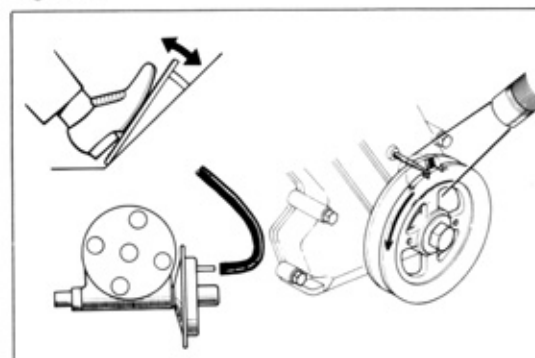
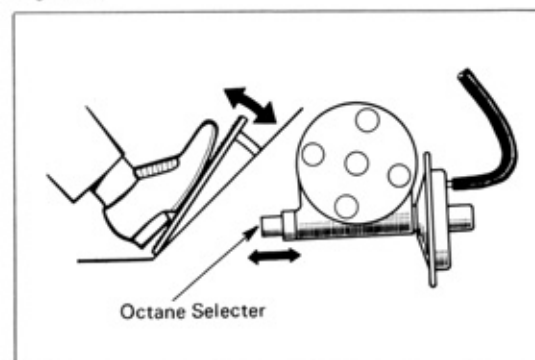


Fig. 2-28



ADJUSTMENT

Align the timing marks by turning distributor body.

Ignition timing 7° BTDC/750 ± 50 rpm
(Red mark)

GOVERNOR OPERATIONAL INSPECTION



1. Rotor should return quickly when turned clockwise by hand and released.
2. Rotor should not be excessively loose.



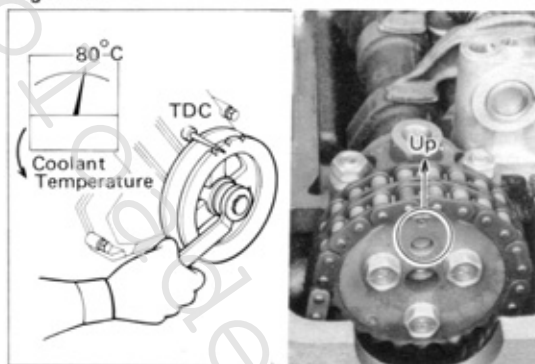
3. Start the engine and disconnect the vacuum hose from the distributor. The timing mark should vary in accordance with the opening and closing of throttle valve.

VACUUM ADVANCE OPERATIONAL INSPECTION



Connect the distributor vacuum hose. The octane selector should vary in accordance with the opening and closing of throttle valve.

Fig. 2-29

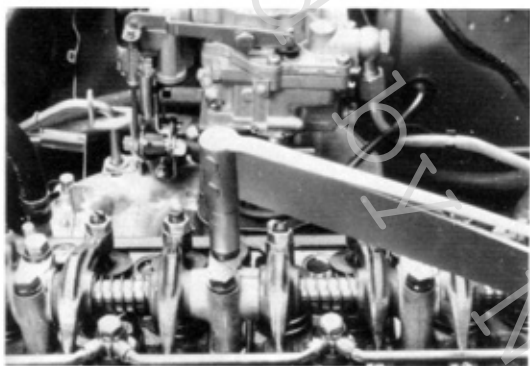


VALEVE CLEARANCE ADJUSTMENT



1. Warm up engine, then stop.
2. Set No.1 cylinder to TDC/compression. At TDC compression position, camshaft knock pin should point up.

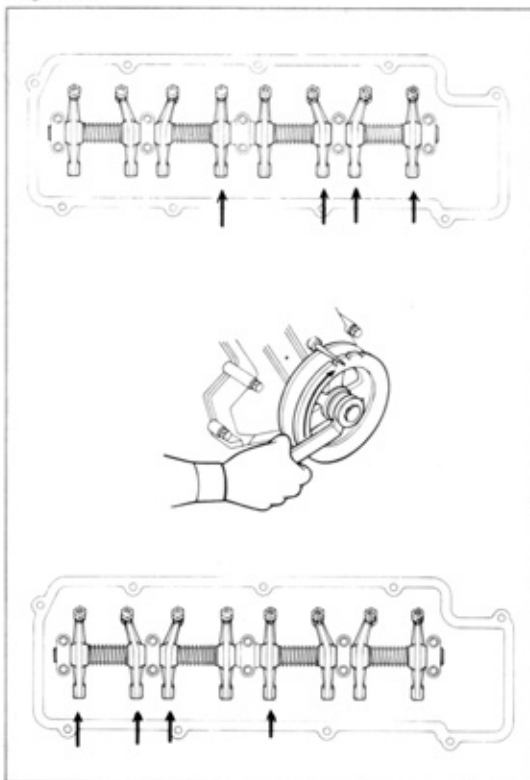
Fig. 2-30



3. Stop the engine.
4. Tighten the rocker support.

Torque **1.7 – 2.3 kg-m**
 (12.3 – 16.6 ft-lb)

Fig. 2-31



5. Make adjustment. Valve clearance is measured between valve stem and rocker arm. Adjust valves indicated by arrows only.

Intake **0.20 mm (0.008 in)**
 0.36 mm (0.012 in)



6. Rotate crankshaft 360°.
7. Adjust remaining valve as arrows.

Fig. 2-32

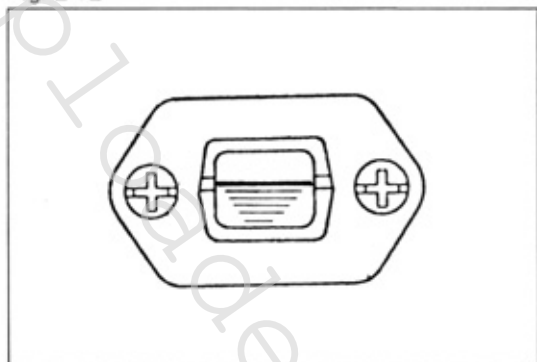


Fig. 2-33

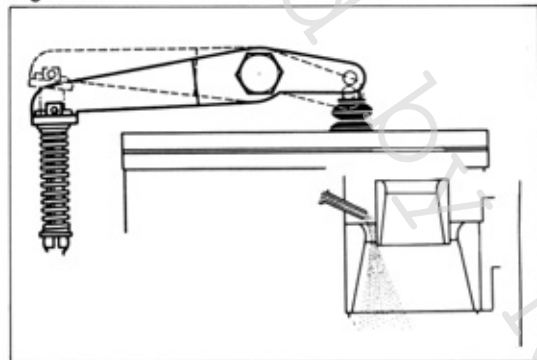


Fig. 2-34

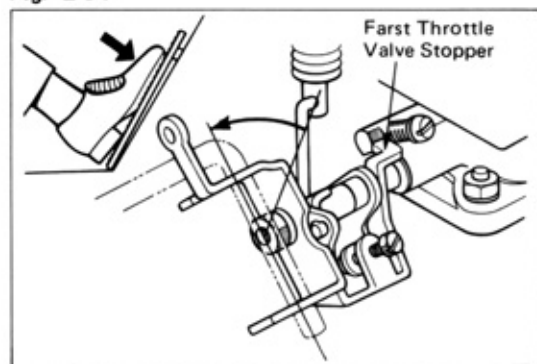
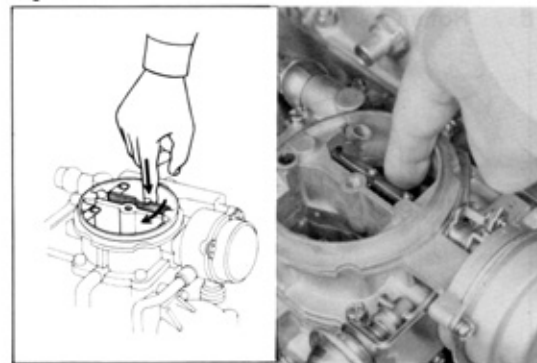


Fig. 2-35



CARBURETOR OPERATIONAL CHECK



1. Check float level.
Float level is satisfactory if the fuel level is up to the standard line when the engine is idling. For adjustment, refer to carburetor section.



2. Check the accelerating pump operation.
Gasoline should shoot out with good force from the jet when the throttle valve is opened.



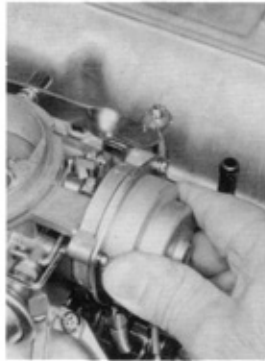
3. Check throttle valve full open.
The throttle valve should open fully when the accelerator pedal is stepped all the way down.

[COLD CONDITION] AUTOMATIC CHOKE



1. Check choke valve action.

Fig. 2-36



2. Choke valve becomes fully closed when atmospheric temperature reaches 25°C (77°F).

Fig. 2-37

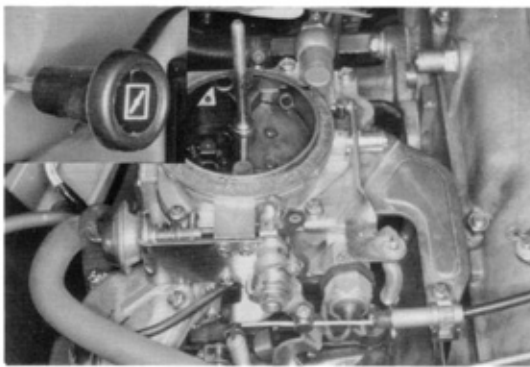


3. Depending on the vehicle operating conditions, turn the coil housing and adjust the engine starting mixture.

If too rich Turn clock-wise.

If too lean ... Turn counterclock-wise.

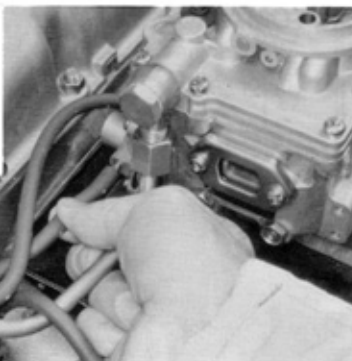
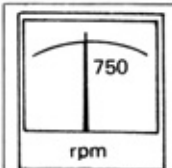
Fig. 2-38



MANUAL CHOKE

1. Choke valve becomes fully closed when fully pulled out choke knob.

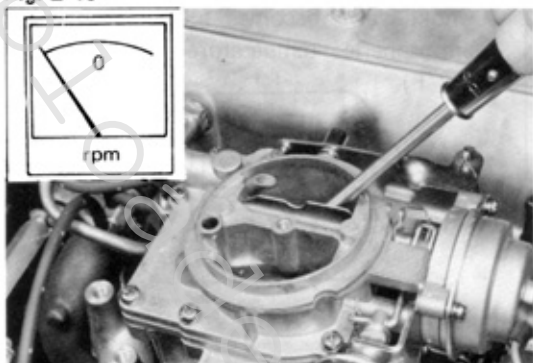
Fig. 2-39



AAP

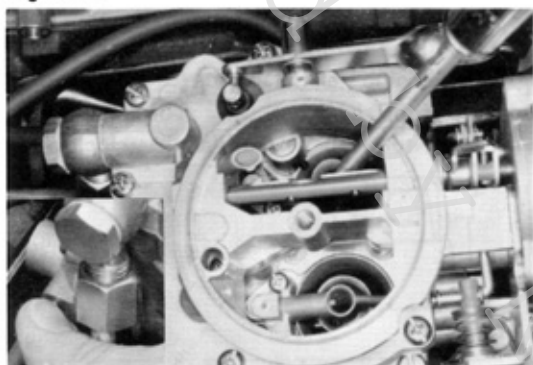
1. Start engine.
2. Pinching AAP hose.

Fig. 2-40



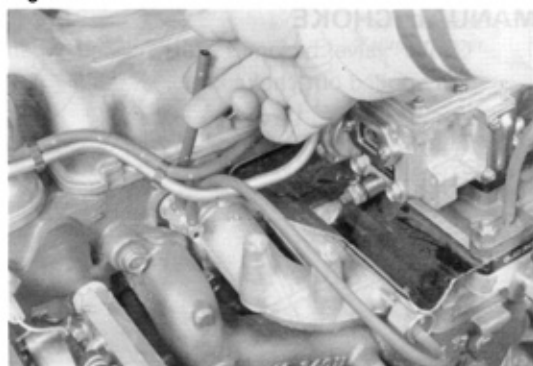
3. Stop engine and open choke valve.

Fig. 2-41



4. Gasoline should shurt out from accelerating jet when AAP hose released.

Fig. 2-42

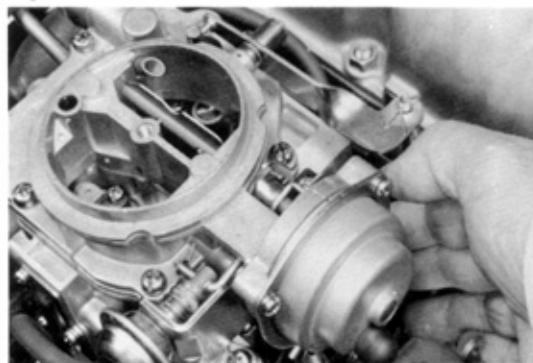


TVSV (for AAP)



1. Have engine idling. (below 60°C, 140°F)
2. When hose is disconnected from AAP diaphragm, engine should run rough idling.

Fig. 2-43

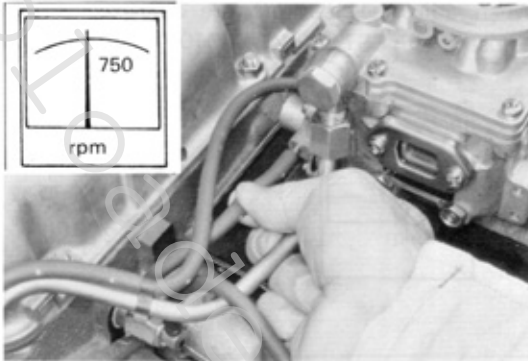


[HOT CONDITION] AUTOMATIC CHOKE



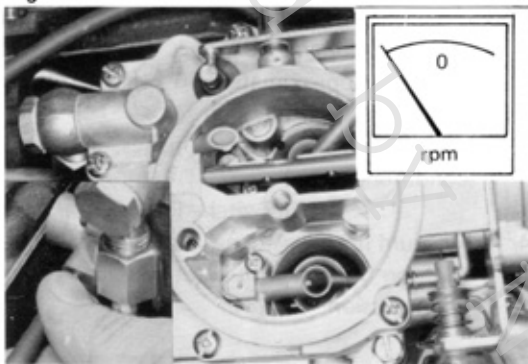
1. With engine warm up, choke valve should be open.

Fig. 2-44

**AAP**

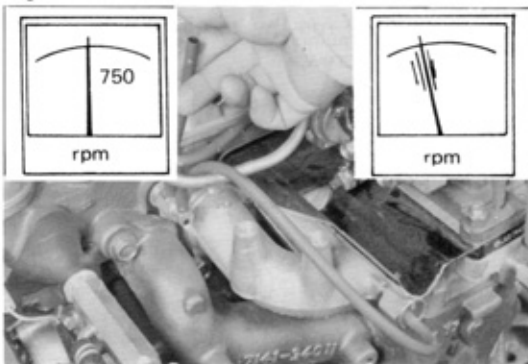
1. Start engine.
2. Pinching AAP hose.

Fig. 2-45



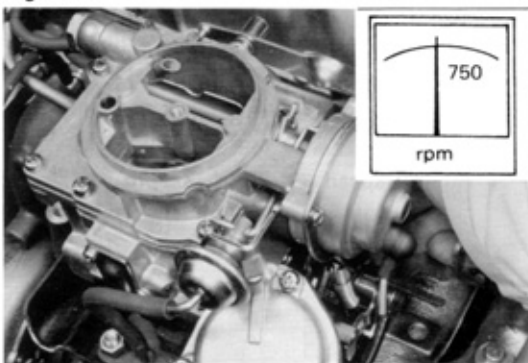
3. Stop engine.
4. Gasoline did not shut out from accelerating jet when AAP hose released.

Fig. 2-46

**TVSV (for AAP)**

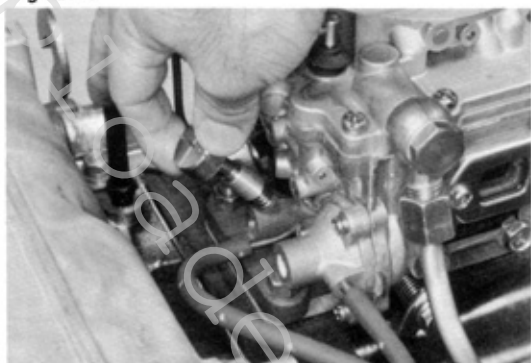
1. Have engine idling. (above 60°C, 140°F)
2. When hose is disconnected from AAP diaphragm, engine should run idling smoothly.

Fig. 2-47

**CHOKE BREAKER**

1. Have engine idling.
2. When hose is disconnected from intake manifold, check to see that choke breaker link is returned.
3. When hose is reconnected to intake manifold, check to see that the choke breaker link is pulled in by diaphragm. If defective, replace diaphragm.

Fig. 2-48



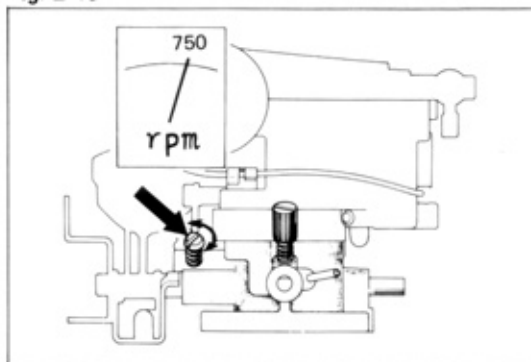
INITIAL IDLE SPEED

When adjusting idle mixture adjusting screw, adjust it with SST [09243-00010].

Check the following items beforehand.

1. Coolant temperature —
Approximately 80°C (180°F)
2. Choke valve — Full open
3. Accessory parts (wipers, heater, lights, air conditioner, etc.)
— All switched off.
4. Vacuum lines — All lines connected.
5. Ignition timing — Initial set position.
6. Transmission — In "N"

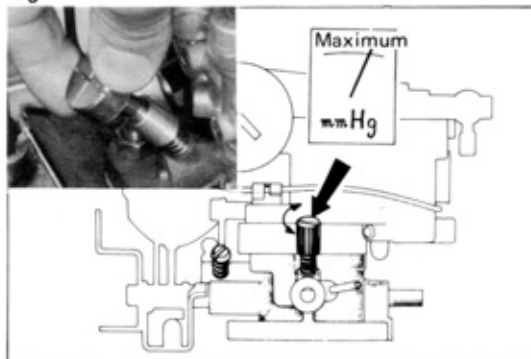
Fig. 2-49



BEST IDLE

1. Set to 750 rpm by turning the idle speed adjusting screw.

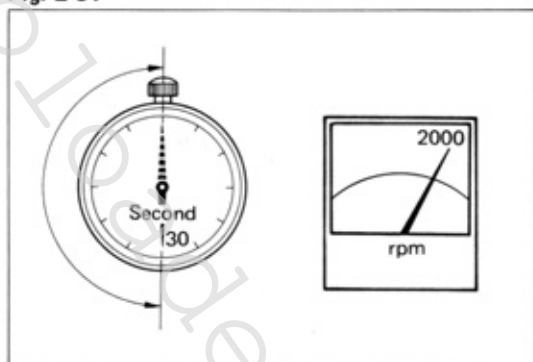
Fig. 2-50



2. Set to the maximum vacuum by turning the idle mixture adjusting screw.
3. Repeat the above adjustments until the specified rpm and maximum vacuum will be obtained.

| | |
|-------------------|-----------------------------|
| Idle speed | 750 ± 50 rpm |
| Vacuum | 420 mmHg (16.5 inHg) |

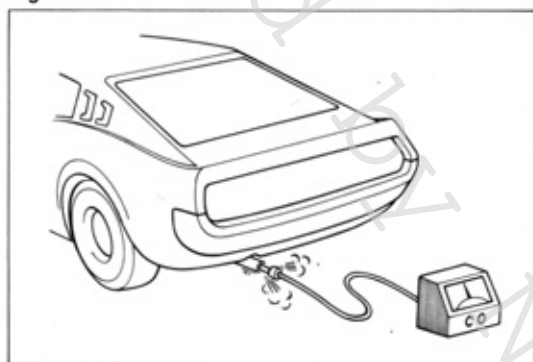
Fig. 2-51



CO CONCENTRATION

1. Measure the CO concentration.
 - (1) Be sure to race the engine before taking measurement. About 2,000 rpm for 30 ~ 60 seconds.

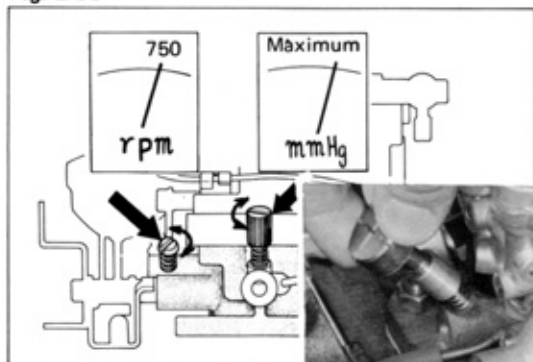
Fig. 2-52



- (2) Measure within 1 to 3 minutes after racing the engine to allow the concentration to stabilize.

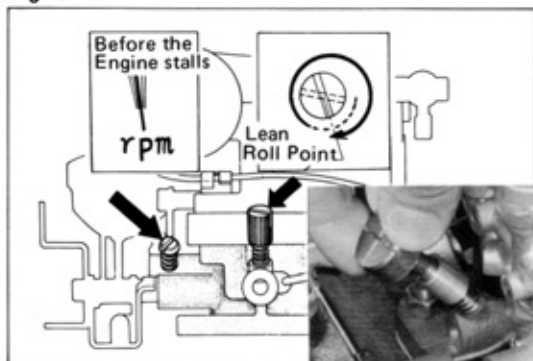
CO concentration Less than 1-3 %

Fig. 2-53



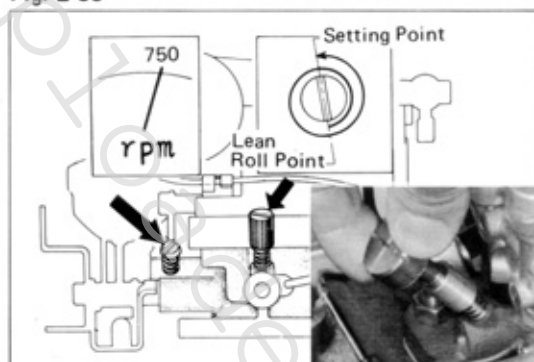
2. Adjust the CO concentration
 - (1) Set to 750 rpm by turning the idle speed adjusting screw.
 - (2) Set to maximum vacuum by turning the idle mixture adjusting screw.
 - (3) Repeat the above steps.

Fig. 2-54



- (4) Turn the idle mixture adjusting screw clockwise to obtain the lean roll point where the engine revolution becomes very rough; just before the engine stalls.

Fig. 2-55



- (5) Turn the idle mixture adjusting screw counter-clockwise about $1\frac{1}{2}$ turns to richer side.
- (6) Then adjust the idle speed adjusting screw to obtain the specified idle speed of 750 rpm.
- (7) Repeat the above steps.

Fig. 2-56

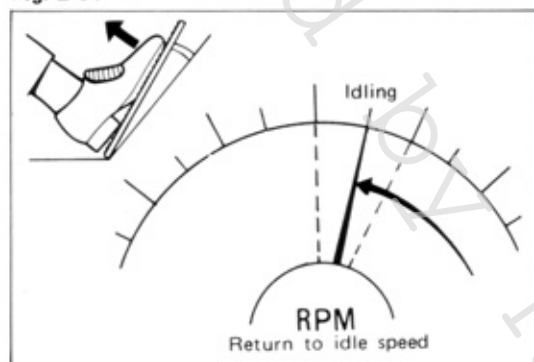


Fig. 2-57

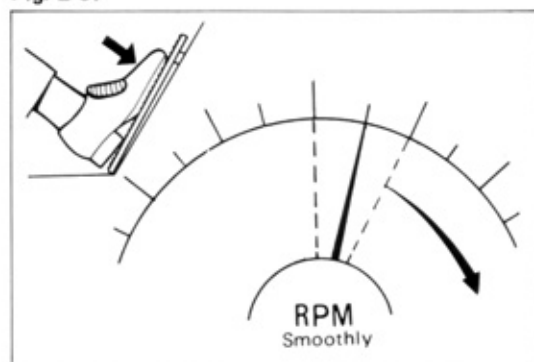
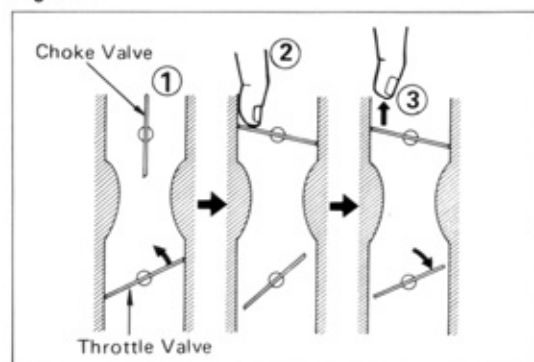


Fig. 2-58



ENGINE CONDITION



1. Check if the engine returns to idle speed when suddenly and slowly accelerated.



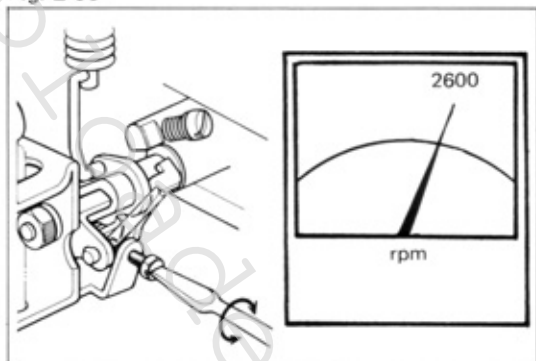
2. Opening throttle valve gradually should cause engine to speed up smoothly in relation to amount of valve opening.

FAST IDLE (Automatic Choke) ADJUSTMENT



1. Stop engine.
2. With the throttle valve slightly open, close the choke valve with finger, then close the throttle valve.
3. Start engine without stepping on the accelerator pedal.

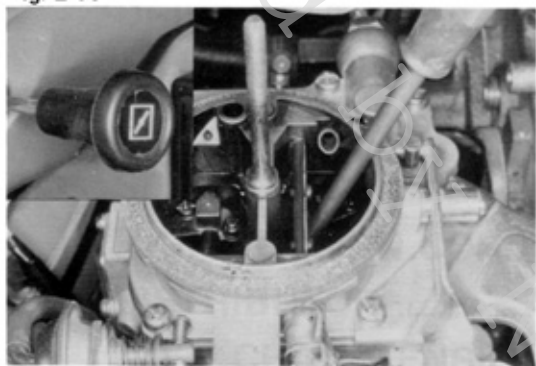
Fig. 2-59



4. Check the engine speed to see if it is the specified rpm.
5. If not, correct by turning the fast idle adjusting screw.

Fast idle speed **2600 ± 200 rpm**

Fig. 2-60

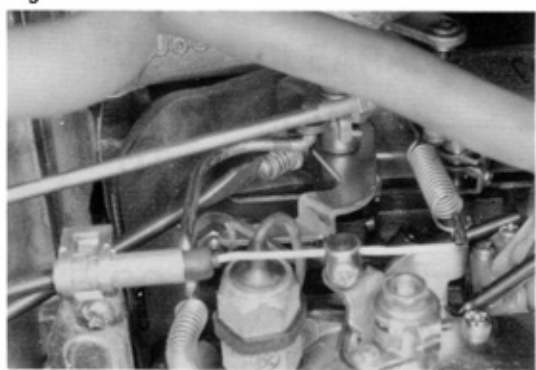


FAST IDLE [Manual Choke] ADJUSTMENT



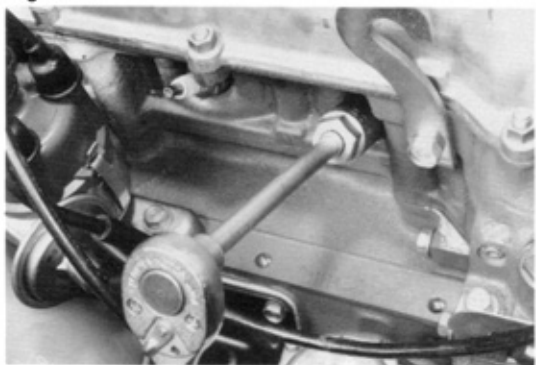
1. Pull choke knob fully.
2. Fully open choke valve with a screwdriver.

Fig. 2-61



3. Start engine.
 4. Adjust by turning fast idle adjusting screw.
- Fast idle speed** **2600 ± 200 rpm**

Fig. 2-62

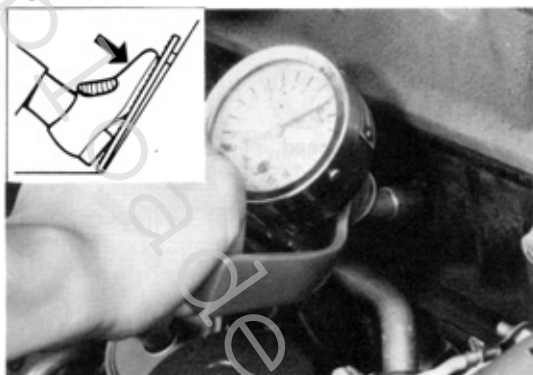


COMPRESSION PRESSURE



1. Warm up the engine.
2. Remove all spark plugs.
3. Disconnect the high tension cord from ignition coil to cut-off the secondary circuit.

Fig. 2-63



4. Insert a compression gauge into the spark plug hole, open the throttle valve fully, and measure the compression pressure while cranking the engine with starter motor.

Compression Pressure

12.0 kg/cm² (170.4 psi)

Limit

9.0 kg/cm² (127.8 psi)

Difference of pressure between cylinder

1.0 kg/cm² (14.2 psi)

18R-G ENGINE TUNE-UP

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18R-G ENGINE TUNE-UP ITEM

| ITEM | | REMARK |
|------|-----------------------------|----------------------------------|
| 1 | ENGINE OIL | |
| | Oil level check | "Full" line |
| | Oil replenishment | API service SE classification |
| | Oil capacity Total | 4.7 liter 5.0 US qt. 4.1 Imp.qt. |
| | Crankcase | 4.2 liter 4.4 US qt. 3.9 Imp.qt. |
| | Quality check | |
| 2 | COOLING SYSTEM | |
| | Oil filter replacement | SST [09228-44010] |
| | Coolant level check | "Full" line |
| | Quality check | |
| 3 | DRIVE BELT | |
| | Coolant capacity (w/heater) | 9.1 liter 9.6 US qt. 8.0 Imp.qt. |
| | Tension Fan — Alternator | 8 — 12 mm 0.31 — 0.47 in |
| | A/C Compressor — Crankshaft | 16 — 19 mm 0.63 — 0.75 in |
| 4 | AIR CLEANER | Element cleaning |
| 5 | BATTERY | |
| | Specific gravity | 1.25 — 1.27 at 20°C 68°F |
| 6 | SPARK PLUG | |
| | Electrolyte level | |
| | Visual check | |
| | Cleaning | |
| 7 | HIGH TENSION CORD | |
| | Plug gap | 0.9 — 1.0 mm 0.035 — 0.039 in |
| 8 | DISTRIBUTOR | |
| | Resistance | Less than 25 kΩ per cord |
| | Distributor cap | |
| | Point gap | 0.45 mm |
| | Dwell angle | 50 — 54° |
| | Dwell angle variation | within 3° |
| | Ignition timing | |
| | at Engine stop | 5° BTDC |
| | Coolant 60°C below | 20° BTDC (Reference only) |
| 9 | NO.2 CHAIN TENSIONER | |
| | Coolant 60°C above | 5° BTDC/1000 rpm |
| | Governor operational | |
| | Vacuum operational | |
| 10 | VALVE TIMING | |
| 11 | VALVE CLEARANCE (COLD) | |
| | Back stroke | 0.5 — 1.0 mm at 3 — 5 kg |
| | | |
| | Intake | SST [09248-27010] |
| | Exhaust | 0.26 — 0.32 mm 0.010 — 0.013 in |
| | | 0.31 — 0.37 mm 0.012 — 0.015 in |

| ITEM | | | REMARK |
|------|----------------------|--|---|
| 12 | CARBURETOR | Float level | SST [09240-27010] 16 — 18 mm 0.63 — 0.71 in |
| | ACCELERATION PUMP | Fuel discharging time | 0.8 — 1.1 second |
| | | Fuel injection direction | |
| | | Starter wire | 50° (at rotally disc) |
| | | Throttle valve full open | |
| | WARM UP ENGINE | | |
| 13 | THROTTLE LINK | Idle speed | 1000 ± 50 rpm |
| | (INITIAL IDLE SPEED) | Manifold vacuum | 330 mm Hg 13.00 in Hg |
| | | Vacuum difference | below 10 mm Hg 0.39 in Hg |
| 14 | BEST IDLE ADJUSTMENT | Idle mixture adjusting screw preset position | Screw out 1½ turn |
| | | Best idle speed | 1000 ± 50 rpm |
| | | Manifold vacuum | above 330 mm Hg 13.00 in Hg |
| 15 | CO CONCENTRATION | | 0.5—0.9 % |
| 16 | ENGINE CONDITION | | |
| 17 | COMPRESSION PRESSURE | Standard | 13.0 kg/cm ² 184.6 psi |
| | | Limit | 10.0 kg/cm ² 142.0 psi |
| | | Difference of pressure between cylinders | Less than 1.0 kg/cm ² 14.2 psi |

Fig. 3-1

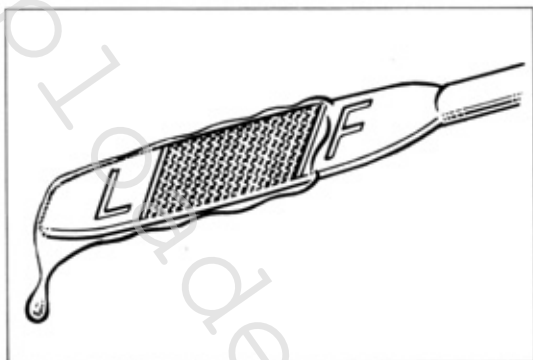


Fig. 3-2

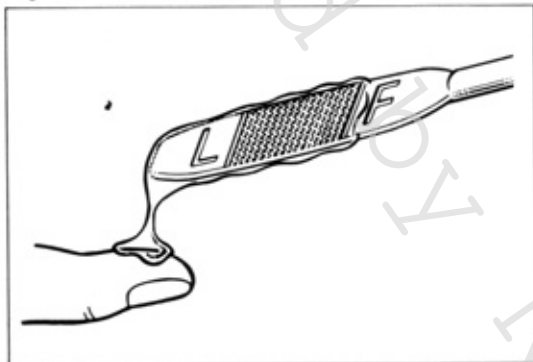


Fig. 3-3

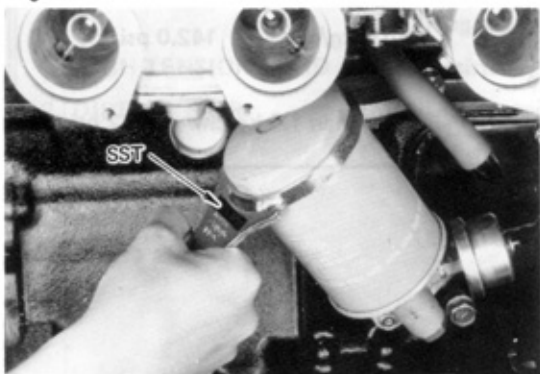


Fig. 3-4



ENGINE OIL



LEVEL CHECK and REPLENISHMENT

Oil level should be up to the F line on the level gauge. If low, add oil up to the F line. Use API service SE classification engine oil.



QUALITY CHECK

Pull out the oil level gauge and examine the oil adhering on the graduated part. The oil should not be discolored or thin.



OIL FILTER REPLACEMENT

1. Remove the oil filter by using SST [09228-34010].
2. For installation, tighten firmly the oil filter by hand.



3. After starting the engine, check for oil leak and recheck the oil level.

Fig. 3-5

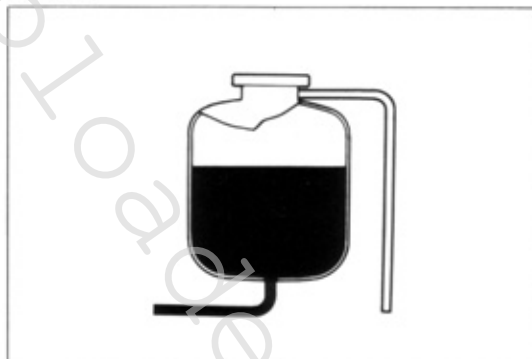


Fig. 3-6



Fig. 3-7

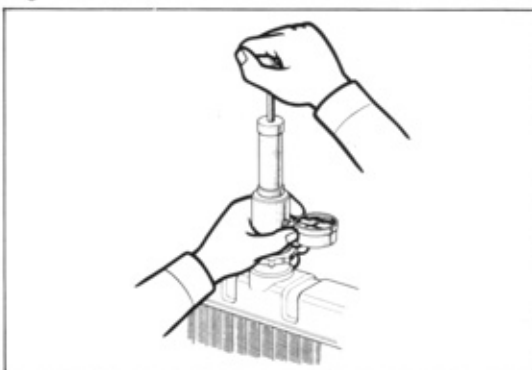
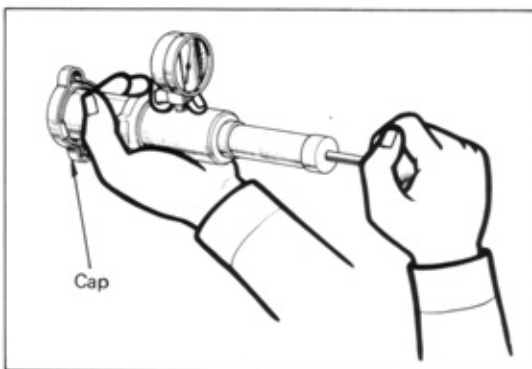


Fig. 3-8



COOLING SYSTEM

COOLANT LEVEL CHECK and REPLENISHMENT



If coolant is low, fill reservoir tank up to "Full" line.

COOLANT QUALITY CHECK



There should not be any excessive deposit of rust or scales around the radiator cap or radiator filler hole, and the coolant should also be free from oil. Replace the coolant if excessively dirty.

INSPECTION of COOLING SYSTEM PARTS



There should be no defects such as listed below:

1. Damage, deterioration, or loose clamps in radiator hoses, water hoses.
2. Leakage due to corrosion or damage in radiator core.
3. Leakage due to loose water drain cock.
4. Leakage from water pump.



5. Faulty operation of radiator cap. Inspect the radiator cap pressure regulating and vacuum valves for spring tension and seating condition. If the valve opens at a pressure level below the specified value or is otherwise defective, replace the radiator cap.

Valve opening pressure limit

0.6 kg/cm² (8.5 psi)

Standard

0.9 kg/cm² (12.8 psi)

Fig. 3-9



Fig. 3-10

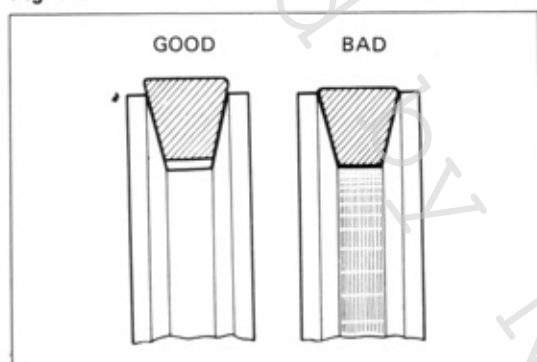


Fig. 3-11

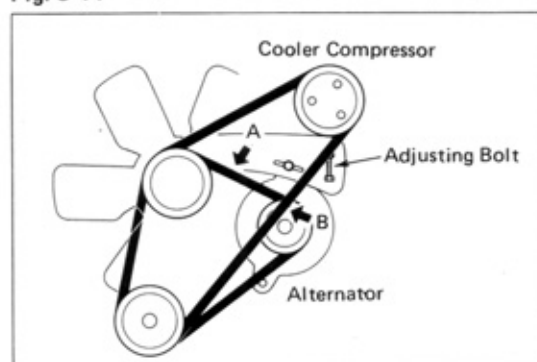


Fig. 3-12



DRIVE BELT VISUAL CHECK



There should be no defects such as listed below:

1. Cracked, deteriorated, stretched, or worn belt.
2. Adherence of oil or grease.



3. Improper contacting of belt against the pulley.

TENSION CHECK and ADJUSTMENT



When the belt is pressed down with 10 kg (22 lb) force, the belt should deflect the specified amount.

A : 8–12mm (0.32–0.47in)

B : 16–19mm (0.63–0.75in)



AIR CLEANER ELEMENT CLEANING

1. In removing the air cleaner or element, and after removal, use care not to drop dirt and dust down into the carburetor.
2. In cleaning the element, blow air from the inner side.
3. In case the element is torn or excessively dirty, replace with new one.

Fig. 3-13

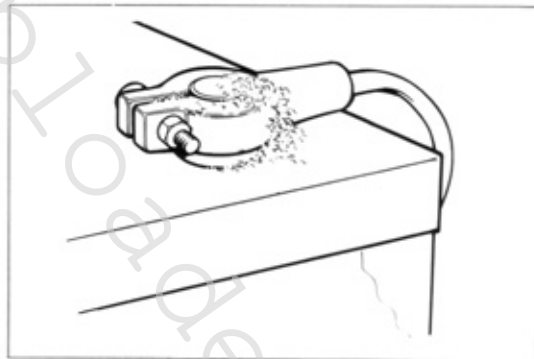


Fig. 3-14

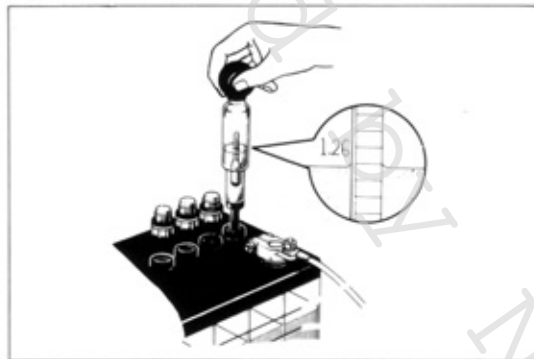


Fig. 3-15

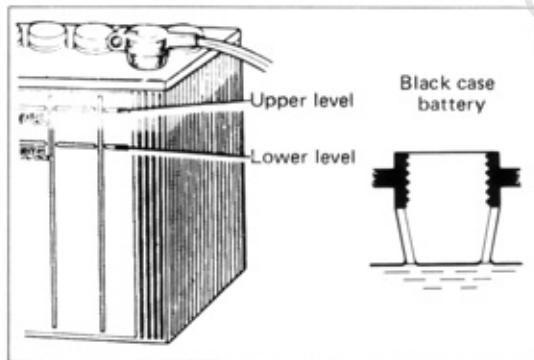
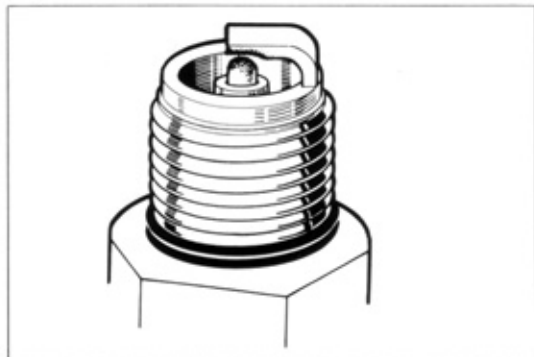


Fig. 3-16



BATTERY VISUAL CHECK

If very dirty, remove and clean before checking. There should be no defects such as listed below:

1. Rusted battery mounting hardware.
2. Damage or leakage in battery.
3. Loose connection, rusting, deterioration or corrosion of battery terminals.



SPECIFIC GRAVITY MEASUREMENT

Hold the hydrometer so that the float will not contact against the cylinder wall and read the graduation.

Specific gravity 1.25–1.27
at 20°C (68°F)



ELECTROLYTE LEVEL CHECK and REPLENISHMENT

The electrolyte level should be up to the upper level. If low, add distilled water (or purified water).



SPARK PLUG VISUAL CHECK

Condition is good if none of the following defects are present:

1. Cracks or damages in the threads or insulator.
2. Wear on the electrodes.
3. Damaged or deteriorated gaskets.
4. Burnt condition of electrode and undesirable carbon deposit.

Fig. 3-17

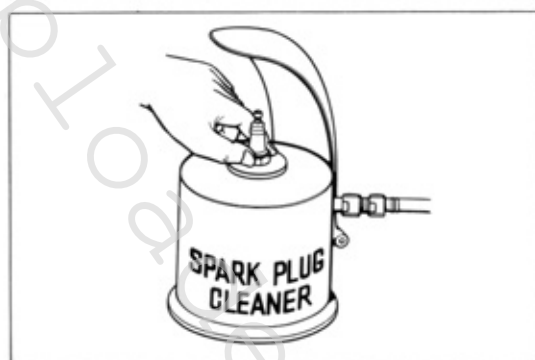


Fig. 3-18

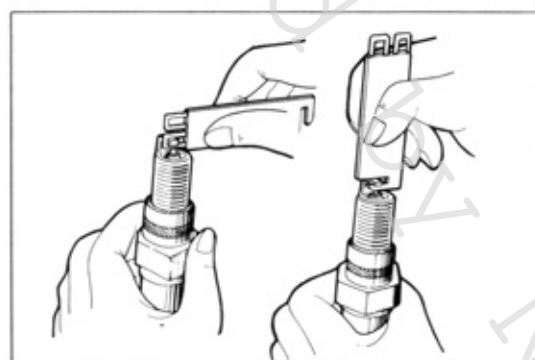


Fig. 3-19

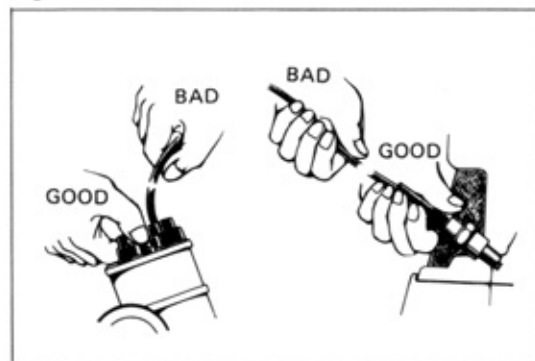
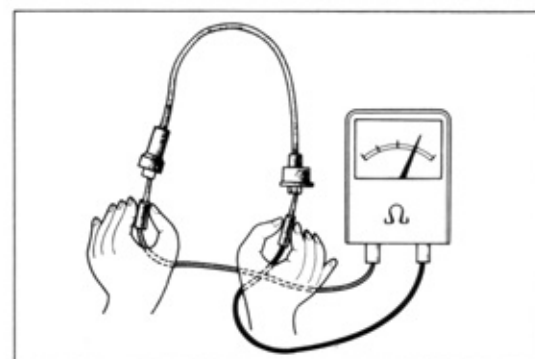


Fig. 3-20



CLEANING



1. Do not use spark plug cleaner longer than necessary.
2. Blow off cleaning compound and carbon on the threads thoroughly with air.
3. Clean off dirt from the outer surface of insulator and threads.

GAP ADJUSTMENT



Check the plug gap with plug gap gauge. If not to specified value, adjust by bending the ground (outer) electrode.

Plug gap 1.0 mm (0.039 in)

HIGH TENSION CORD



— Note —

When pulling out the spark plug cord from the plug, always grip the end of plug cord.



Check the resistance of resistivity cord.

Resistance Less than 25 kΩ per cord.

Fig. 3-21

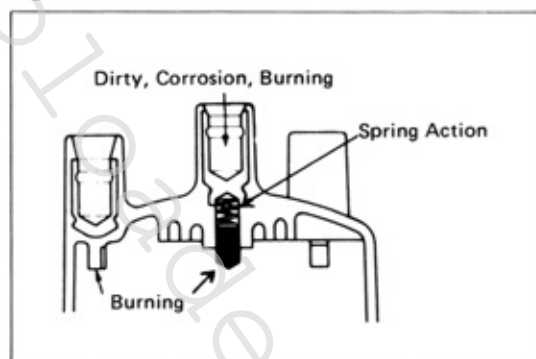


Fig. 3-22

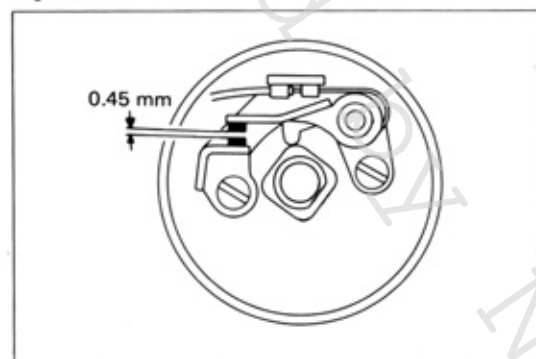


Fig. 3-23

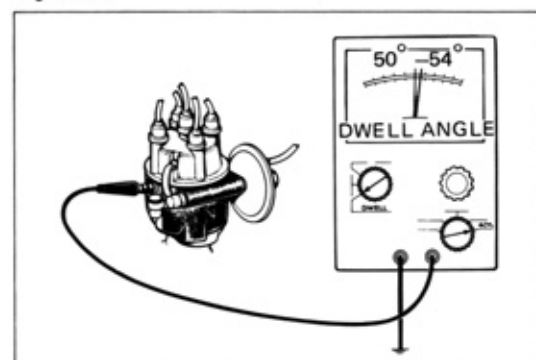
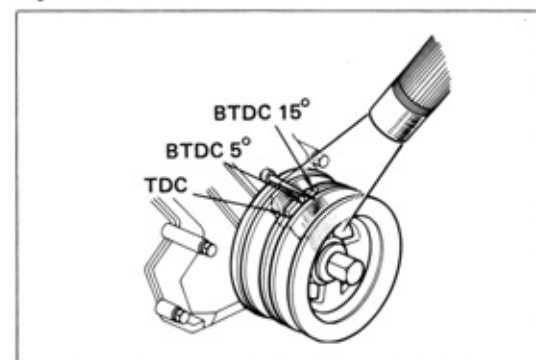


Fig. 3-24



DISTRIBUTOR

CAP INSPECTION

Clean the distributor cap and inspect the cap and rotor for:

1. Cracks, damage, dirty cord hole, corrosion, burning.
2. Center piece spring action.
3. Burnt electrode terminal.

POINT GAP ADJUSTMENT

1. If the points are excessively burnt or pitted, replace the breaker points.
2. Adjust point gap.

Point gap 0.45 mm (0.018 in)

DWELL ANGLE

Check if dwell angle is within the specified value.

Dwell angle 50–54°

Variation Within 3° (at idling to 2000 rpm)

IGNITION TIMING

INSPECTION

Set the engine revolution at idle speed, the octane selector must be set at standard position.

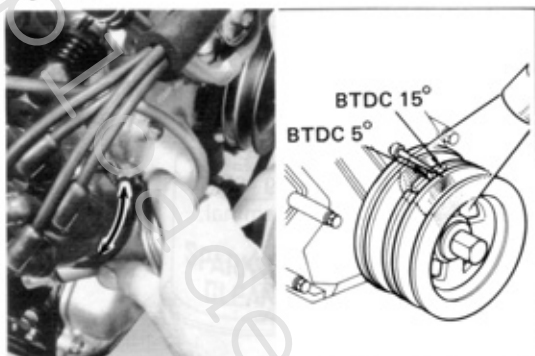
Ignition timing

at Engine Stop 5° BTDC

Coolant 60°C below 20° BTDC (Reference only)

Coolant 60°C above 5° BTDC/1000rpm

Fig. 3-25

**ADJUSTMENT**

Align the timing marks by turning distributor body.

Ignition timing

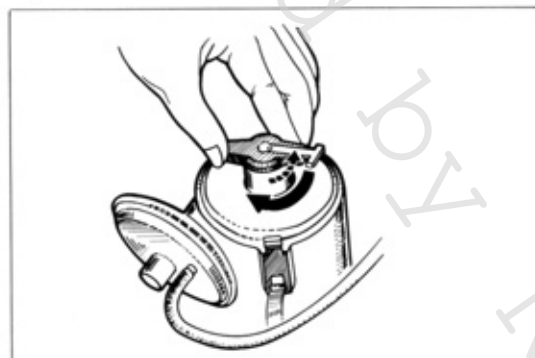
Coolant above 60°C

5° BTDC/1000 rpm

Coolant below 60°C

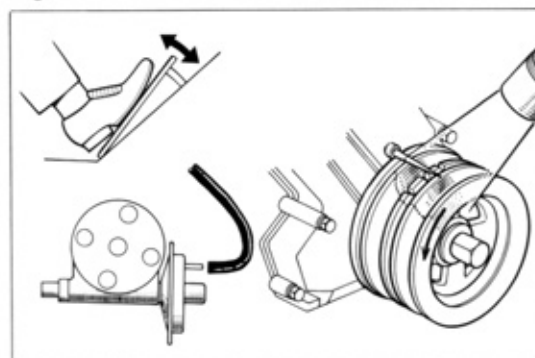
20° BTDC (Reference only)

Fig. 3-26

**GOVERNOR OPERATIONAL INSPECTION**

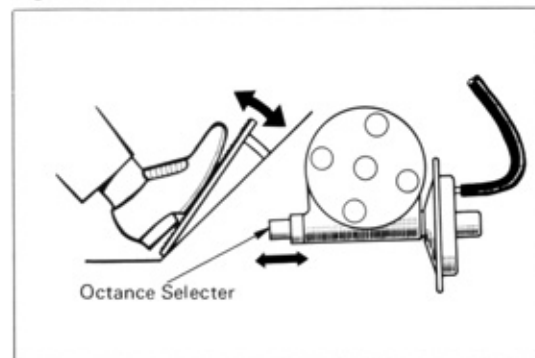
1. Rotor should return quickly when turned clockwise by hand and released.
2. Rotor should not be excessively loose.

Fig. 3-27



3. Start the engine and disconnect the vacuum hose from the distributor. The timing mark should vary in accordance with the opening and closing of throttle valve.

Fig. 3-28

**VACUUM ADVANCE OPERATIONAL INSPECTION**

Connect the distributor vacuum hose.

The octane selector should vary in accordance with the opening and closing of throttle valve.

Fig. 3-29

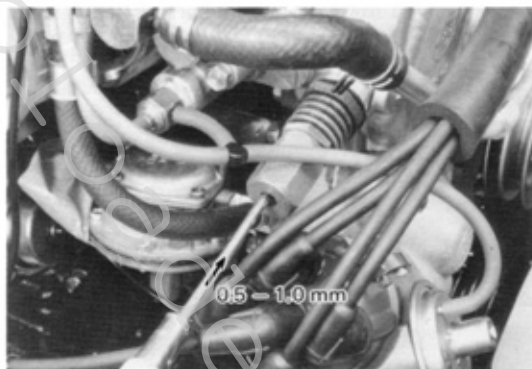


Fig. 3-30

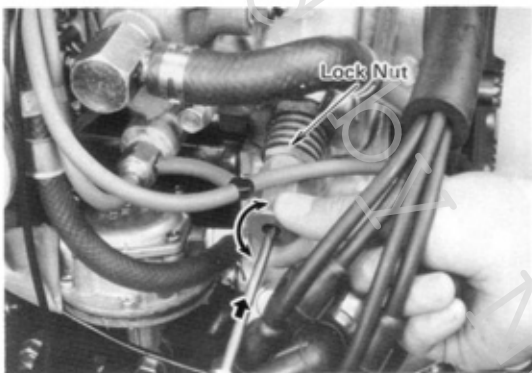


Fig. 3-31

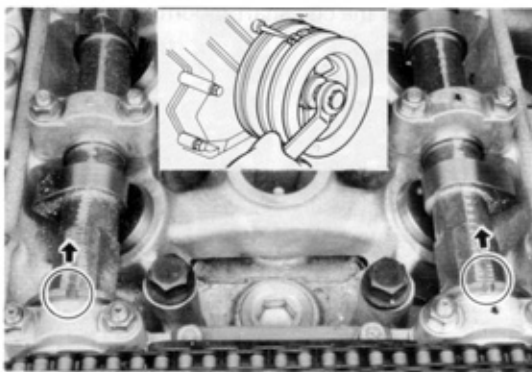
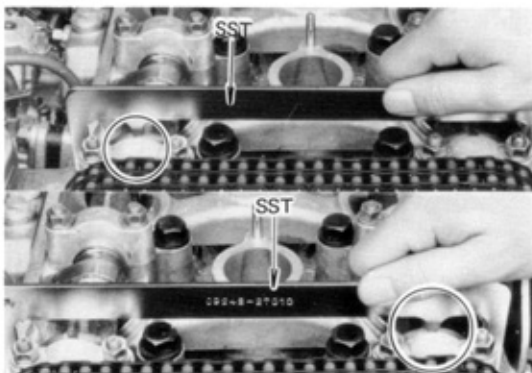


Fig. 3-32



NO.2 CHAIN TENSIONER CHECK THE BACK STROKE

Press down the plunger with 3–5kg (6.6–11.0lb) force and measure the stroke.

Stroke 0.5–1.0mm (0.02–0.04in)



ADJUSTMENT

1. Loosen the lock nut.
2. Press the plunger with 3 ~ 5kg (6.6 ~ 11.0 lbs) force and screw in the adjust nut until it rests on the plunger.
3. Unscrew the adjust nut 1/3~2/3 turns and secure it with lock nut.
4. Check the stroke to see that it is within the specified value.

VALVE TIMING INSPECTION

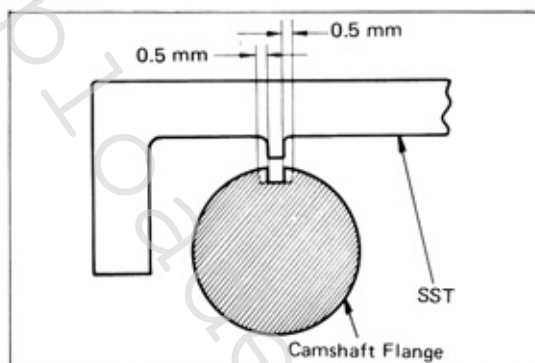


1. Remove the engine cylinder head cover.
2. Set No. 1 cylinder to TDC/compression. At TDC compression position, timing check slits in the flange of camshafts are positioned upward.



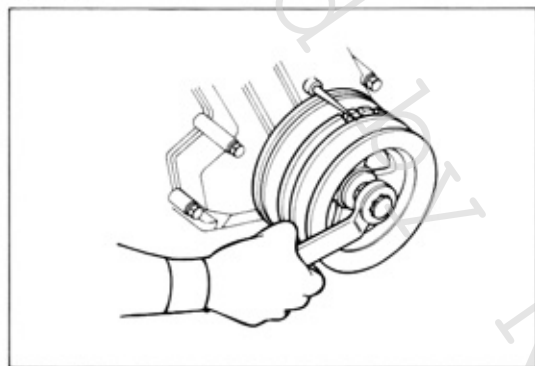
3. Check the positions of camshaft No. 1 and No. 2.
Use SST [09248-27010].

Fig. 3-33



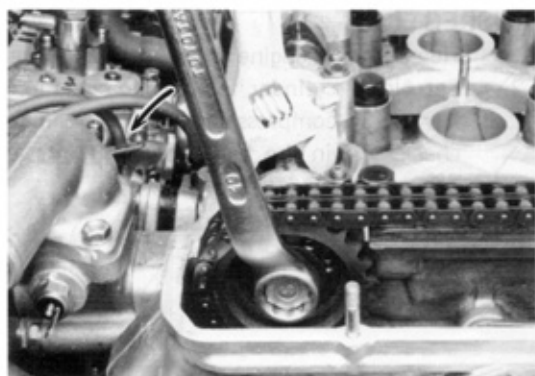
4. Valve timing permissible error
 $\pm 2^\circ$ Camshaft rotation angle.
 $\pm 0.5\text{mm}$ (0.020in)
 Camshaft flange outer perimeter.

Fig. 3-34

**ADJUSTMENT**

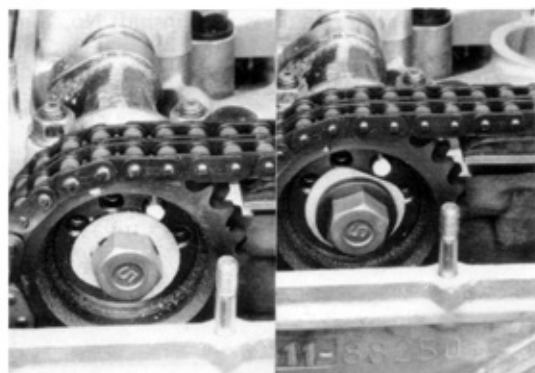
1. Reset No. 1 cylinder TDC/compression.

Fig. 3-35



2. Loosen the camshaft mounting bolt.

Fig. 3-36



3. Shift the washer.

Fig. 3-37

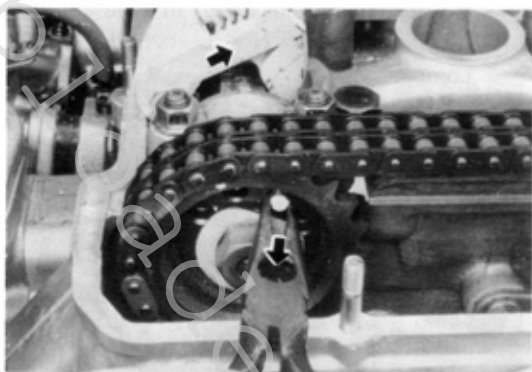


Fig. 3-38

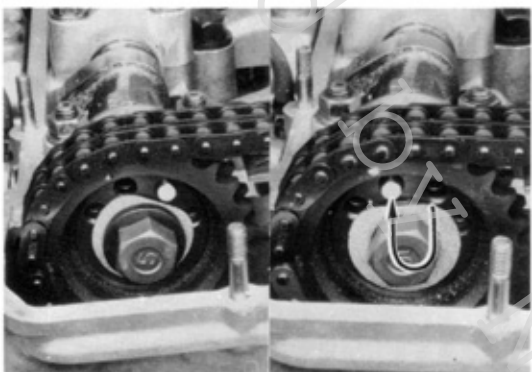


Fig. 3-39

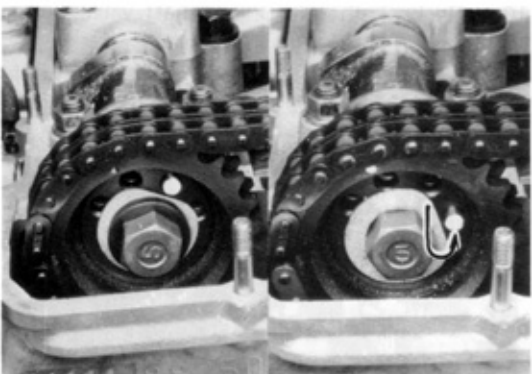
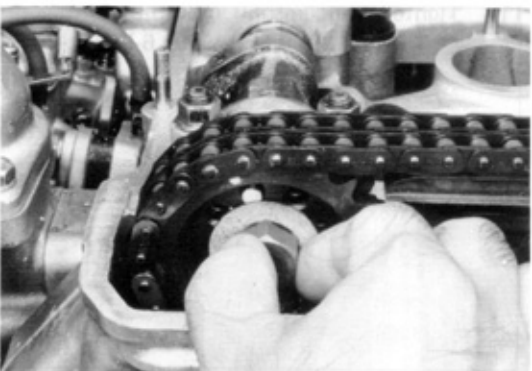


Fig. 3-40



4. It will be easier to pull out the pin if the camshaft is turned slightly in the forward direction so as to provide play.

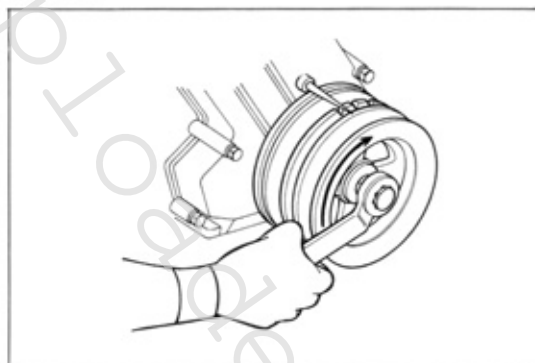
5. When valve timing is advanced.
- (1) Align with pin hole in counterclock wise direction.
 - (2) Turn the camshaft so that its slit will be lined up with the adjust gauge and reinsert the pin.

6. When valve timing is retarded
- (1) Align with hole pin in clock wise direction.
 - (2) Turn the camshaft so that its slit will be lined up with the adjust gauge and reinsert the pin.



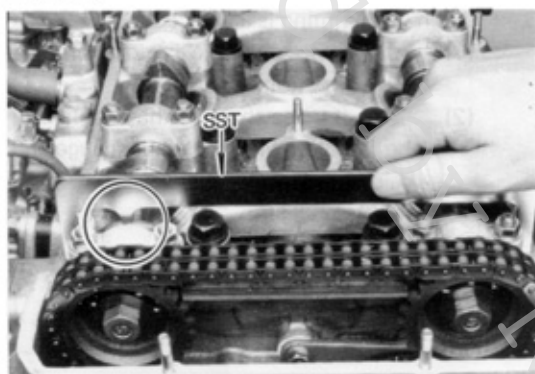
7. Hold the pin with the washer and tighten the bolt.

Fig. 3-41



8. Rotate the crankshaft in the normal direction until No. 1 cylinder TDC/compression.

Fig. 3-42



9. Recheck the No. 1 camshaft valve timing with SST [09248-27010]. Camshaft slit and SST protrusion should match up.

Fig. 3-43



10. Recheck the No. 2 camshaft valve timing with SST [09248-27010]. Camshaft slit and SST protrusion should match up.

Fig. 3-44



11. Tighten the camshaft mounting bolt.
Torque 7.0-8.0kg-m (50.6-57.9ft-lb)

Fig. 3-45

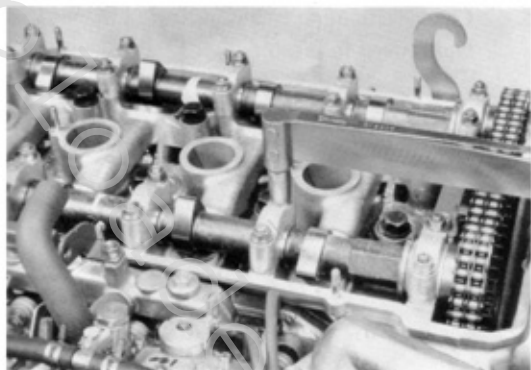


Fig. 3-46

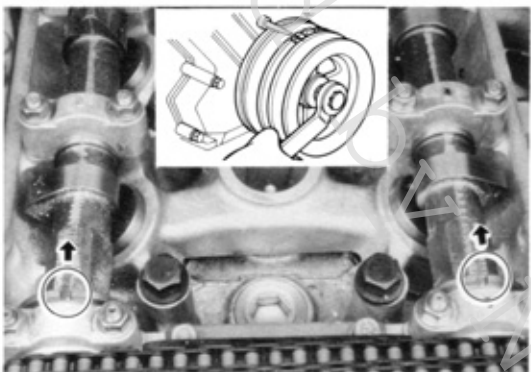


Fig. 3-47

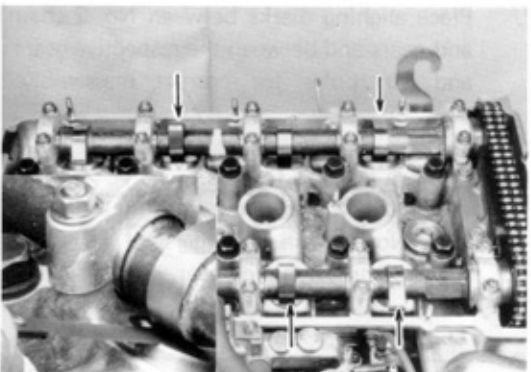
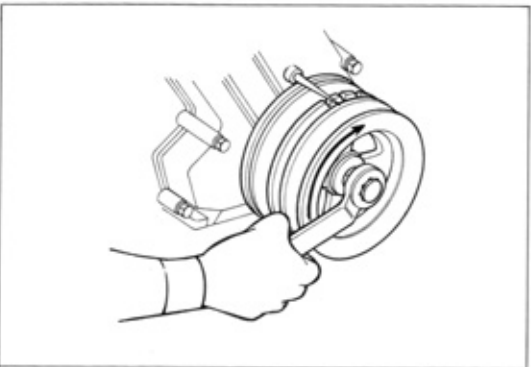


Fig. 3-48



VALVE CLEARANCE

(THE ENGINE SHOULD BE IN COLD CONDITION)

INSPECTION



1. Make sure of the following.

- (1) Camshaft bearing cap. 1.2-1.8kg-m (8.7-13.0ft-lb)
- (2) Valve timing. Use SST [09248-27010].



2. Set No. 1 cylinder to TDC/compression. In this condition, timing check slits in the flange of camshafts are positioned upward.



3. Measure only valve clearance indicated by arrows and record the results.

Clearance

Intake 0.26-0.32 mm (0.010-0.013 in)

Exhaust 0.31-0.37 mm (0.012-0.015 in)



4. Rotate crankshaft 360° in the normal direction until No. 4 cylinder TDC/compression.

Fig. 3-49

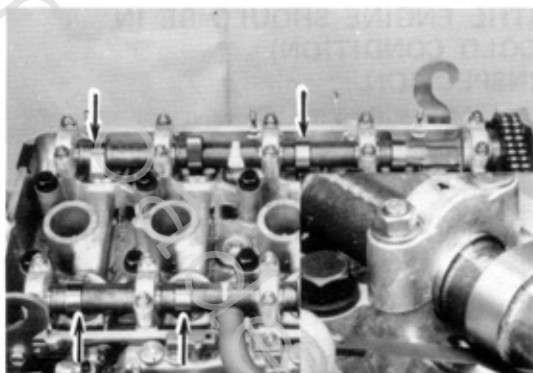


Fig. 3-50

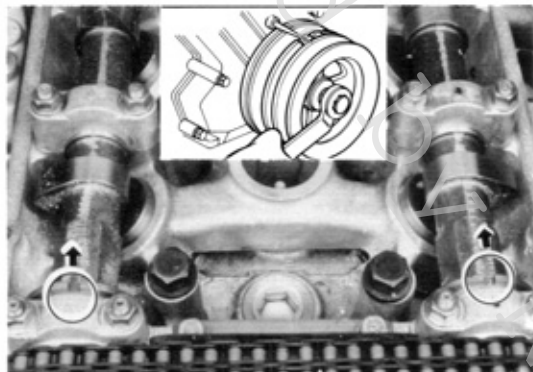


Fig. 3-51

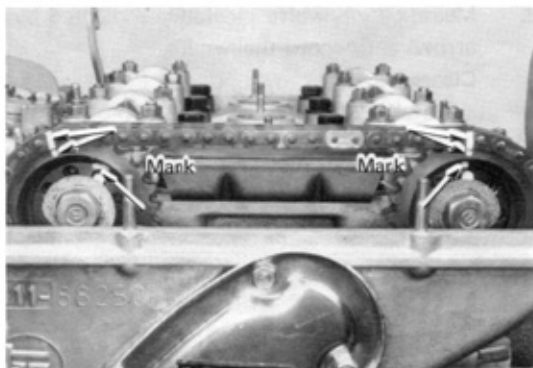
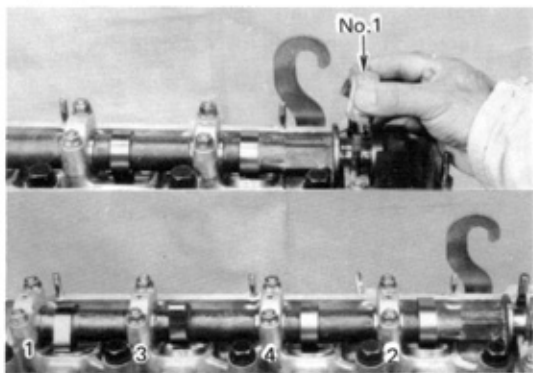


Fig. 3-52



5. Check remaining valves indicated by arrows and record the results.

ADJUSTMENT



In case any of the measured valves are not within the specified values.

1. Set No. 1 cylinder to TDC/compression.



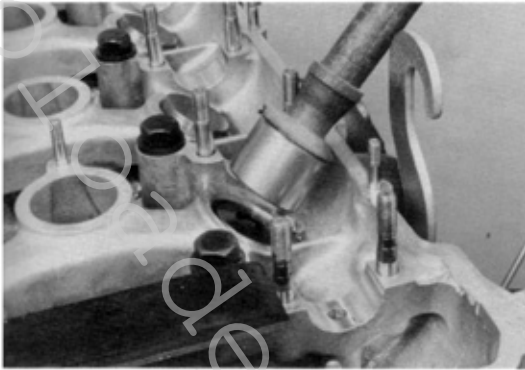
2. Place aligning marks between No. 2 chain and gears and between the respective gears and pin holes for correct reassembly.

3. Remove parts as follows.
 - (1) No. 2 chain damper.
 - (2) No. 2 chain tensioner.
 - (3) Camshaft timing gear.



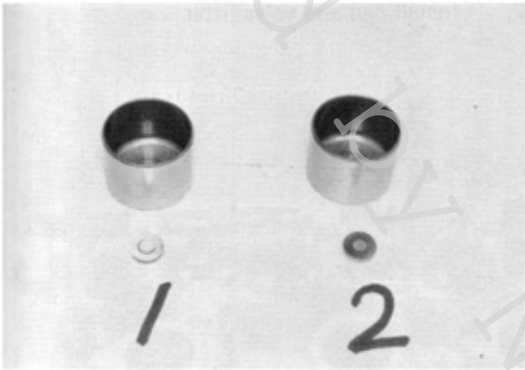
- (4) Camshaft No. 1 bearing cap.
- (5) Gradually loosen No. 2 to No. 5 bearing cap nuts in 2 to 3 stages in the sequence as shown.
- (6) Camshaft.

Fig. 3-53



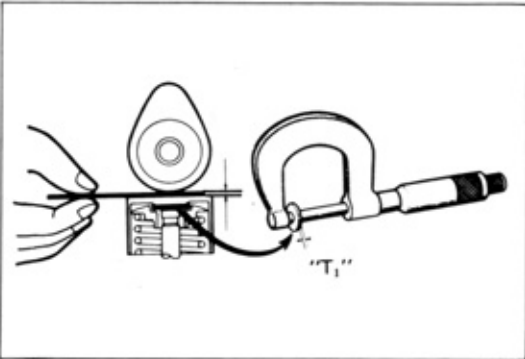
4. Remove valve lifter when valve clearance is not within specified valve.

Fig. 3-54



5. Keep valves and adjusting pads in order.

Fig. 3-55



6. Select a new pad that will give the specified valve clearance as follows.

- (1) Measure the pad that was off with a micrometer.



Intake Side

$$\text{New Pad Thickness} = T_1 + (A - 0.29\text{mm})$$

Exhaust Side

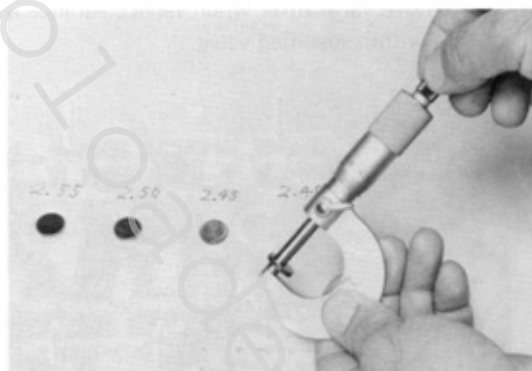
$$\text{New Pad Thickness} = T_1 + (A - 0.34\text{mm})$$

- (2) Calculate thickness of new pad so valve clearance comes within specified valve.

T₁..... Thickness of pad used

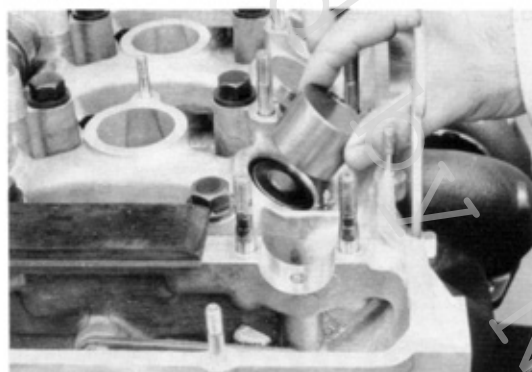
A Valve clearance measured

Fig. 3-56



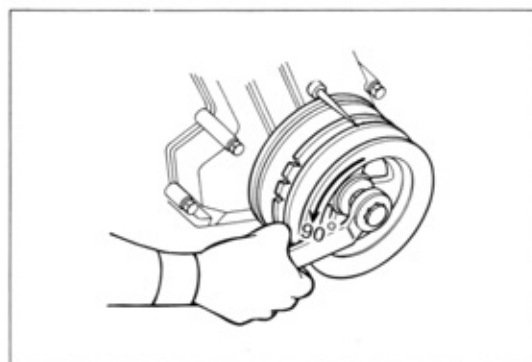
- (3) Select a pad with a thickness as close as possible to the valve calculated. Pads are available in 41 sizes, in increments of 0.05 mm (0.002 in), from 1.00 mm (0.039 in) to 3.00 mm (0.118 in).

Fig. 3-57



7. Install pad and valve lifter

Fig. 3-58

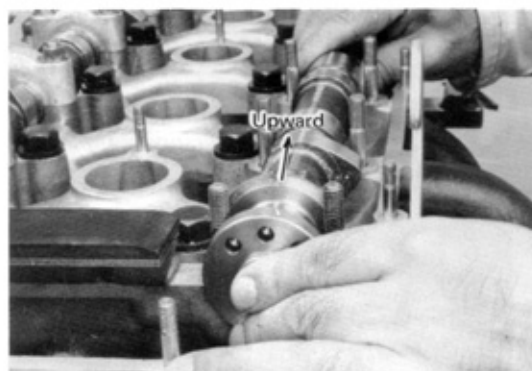


8. Install the camshaft
(1) Rotate the crankshaft about 90° the reverse direction.

— Caution —

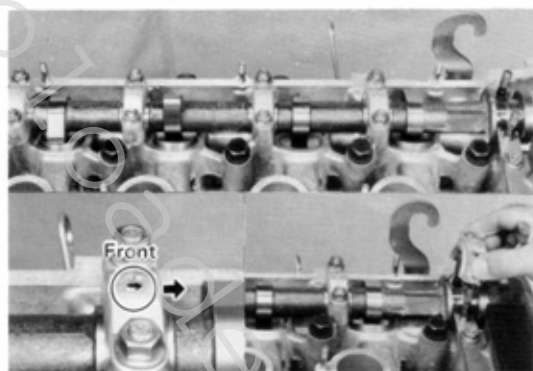
Lower piston to prevent interference of piston head and valve.

Fig. 3-59



- (2) Position slit of camshaft upward as shown.

Fig. 3-60



- (3) Install the No. 2 to No. 5 camshaft bearing caps.

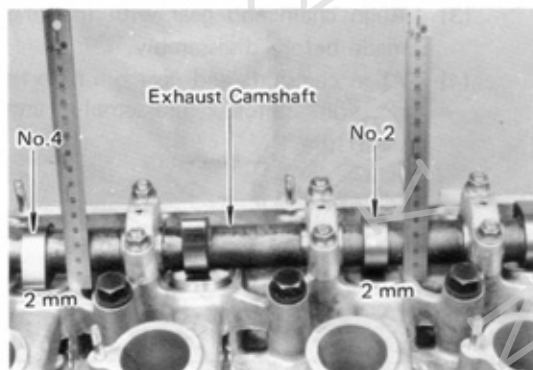
Face the arrow mark toward front.

- (4) Gradually tighten bearing cap nuts in 3 to 4 stages in the sequence as shown.

Torque 1.7-2.3 kg-m (12.3-16.6 ft-lb)

- (5) Then tighten No. 1 bearing cap to 1.2-1.8kg-m (8.7-13.0ft-lb).

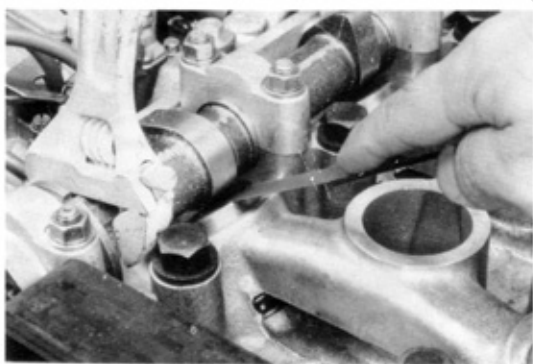
Fig. 3-61



9. Recheck intake side valve clearance.

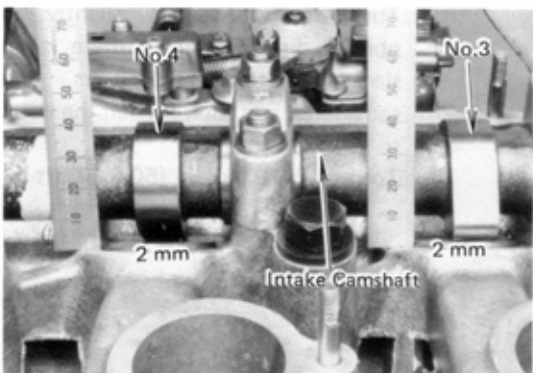
- (1) Exhaust side valve lifter No. 2 and No. 4 should protrude the same amount (approx. 2 mm)

Fig. 3-62



- (2) Measure intake side valve clearance. If outside the specified valve, choose another pad.

Fig. 3-63



10. Recheck exhaust side valve clearance.

- (1) Intake side valve lifter No. 3 and No. 4 should protrude the same amount.

- (2) Measure exhaust side clearance. If outside the specified value, choose another pad.

Fig. 3-64

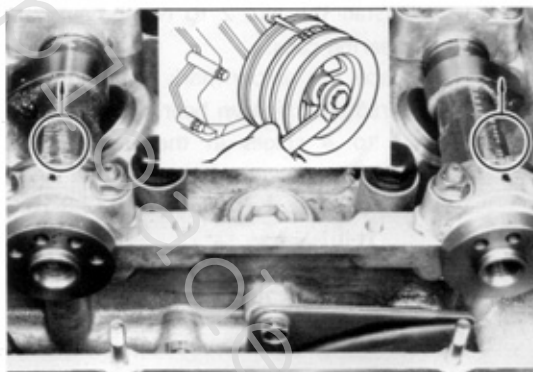


Fig. 3-65

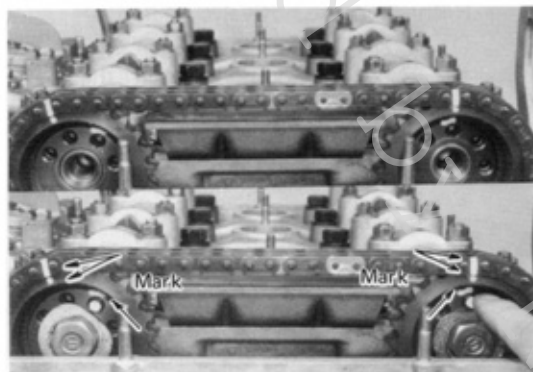


Fig. 3-66

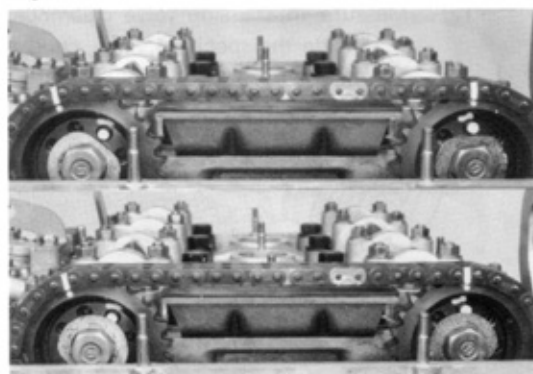
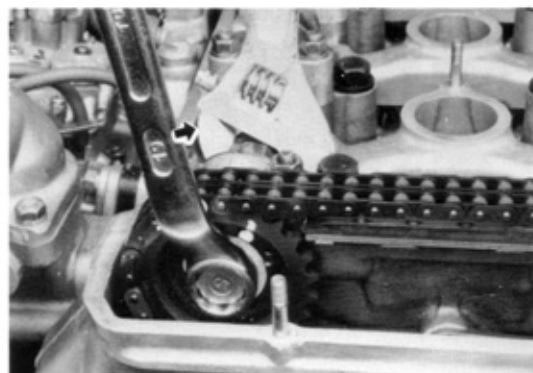


Fig. 3-67



11. Install the No. 2 chain and camshaft gears.
 - (1) Position the No. 1 and No. 2 camshaft slit vertically upward with SST [09248-27010].
 - (2) Set the No. 1 cylinder to TDC/compression.



- (3) Align chain and gear with marking made before disassembly.
- (4) Align camshaft and gear pin hole to position before disassembly and insert pin.



- (5) Hold the pin with the washer.



- (6) Turn the crankshaft slightly in normal direction, until there is no slack in the pins, gears, and camshafts, and then tighten the bolts to specified torques.

Torque 7.0-8.0kg-m (50.6-57.8ft-lb)

Fig. 3-68

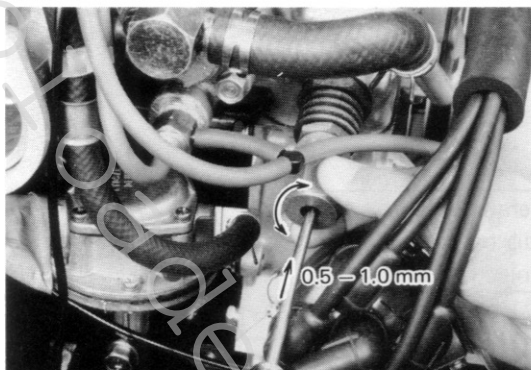


Fig. 3-69

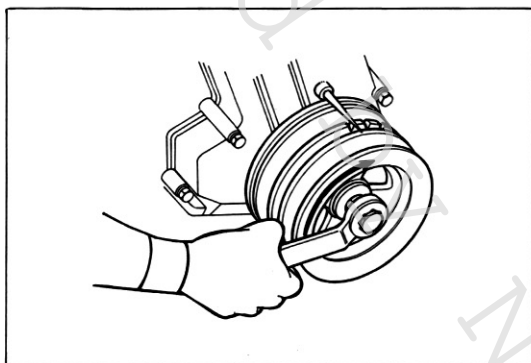
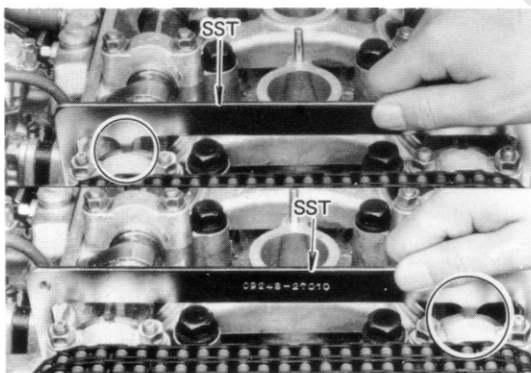


Fig. 3-70



- (7) Adjust the No. 2 chain tensioner.
Back stroke 0.5-1.0mm (0.02-0.04in)
at 3-5kg (6.6-11lb)



12. Recheck valve timing.

- (1) Rotate the crankshaft two turn in normal direction until No. 1 cylinder TDC/comperssion.



- (3) Recheck valve timing with SST [09248-27010].

CARBURATOR

CARBURATOR ADJUSTMENT PROCEDURES

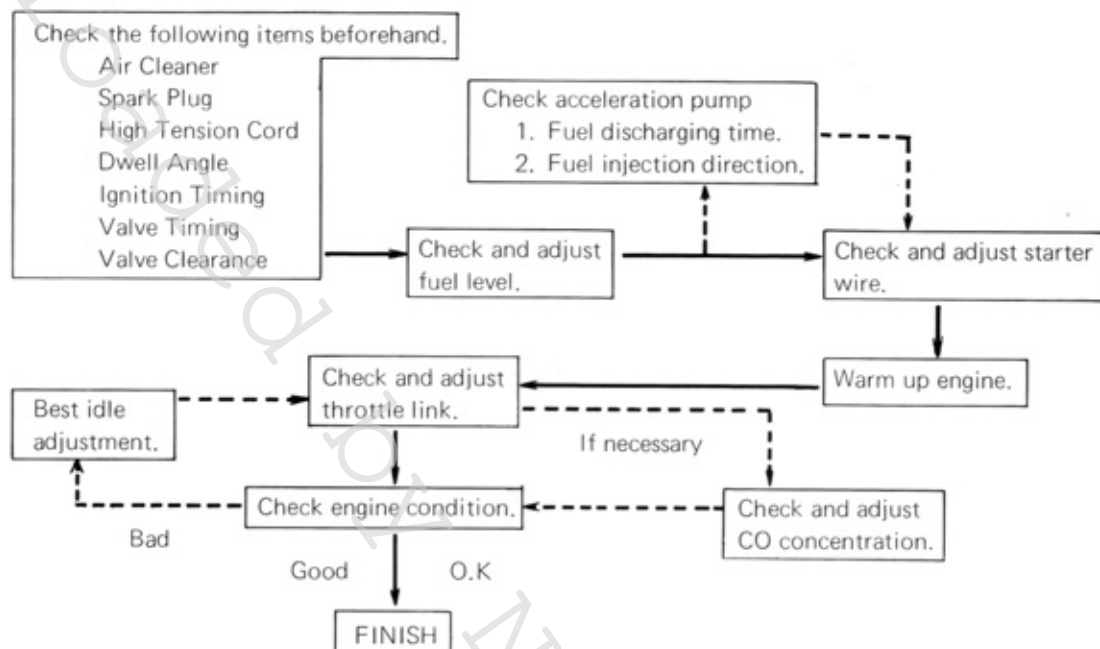


Fig. 3-71

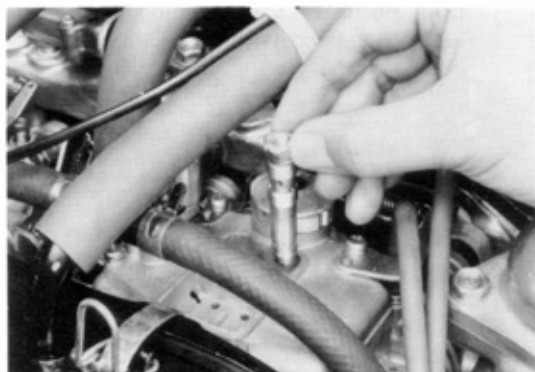
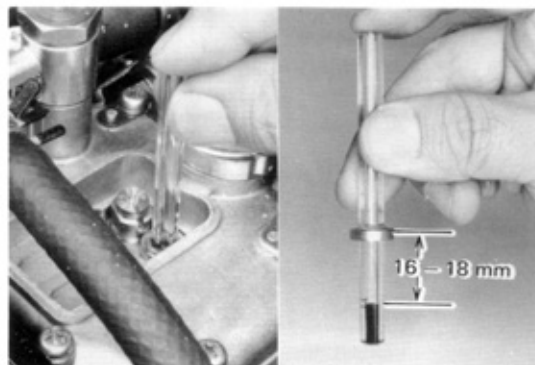


Fig. 3-72



FLOAT LEVEL

Inspection



1. Start the engine and idle.
About 1000rpm
2. Take out one of the main jet holders in assembled form.



3. Insert SST [09240-27010] in the hole from which the main jet holder was removed.
4. Check the gasoline level inside the gauge to see if within the limit.

Standard level 16-18mm (0.63-0.71in)

Fig. 3-73

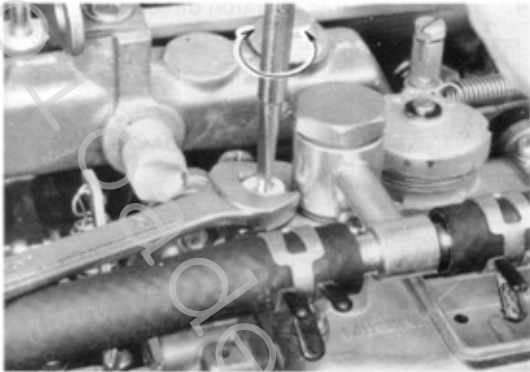


Fig. 3-74

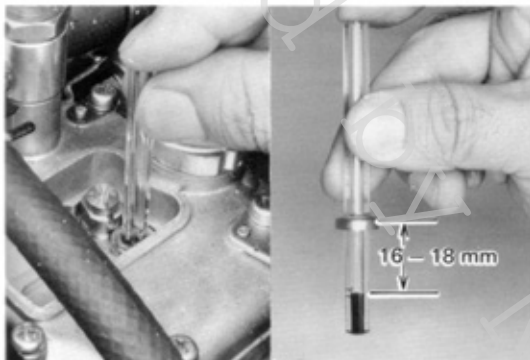
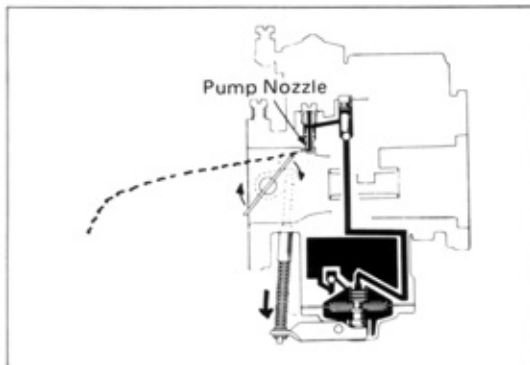


Fig. 3-75



Fig. 3-76

**ADJUSTMENT**

1. Adjust by turning the float level adjusting screw.

One turn

Float level change to 1.8mm (0.07in)



2. Recheck the float level.
Condition where the fuel pump is operating and applying fuel pressure.

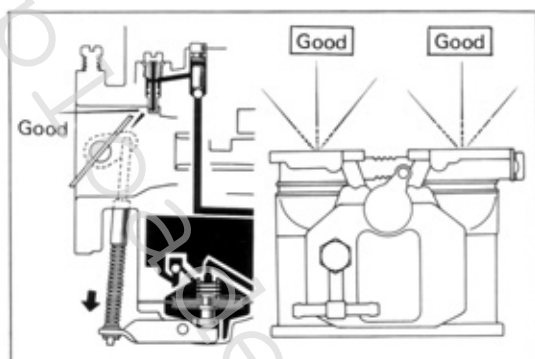
ACCELERATION PUMP INSPECTION

1. Remove the carburetor.
2. Check the fuel in the float chamber.



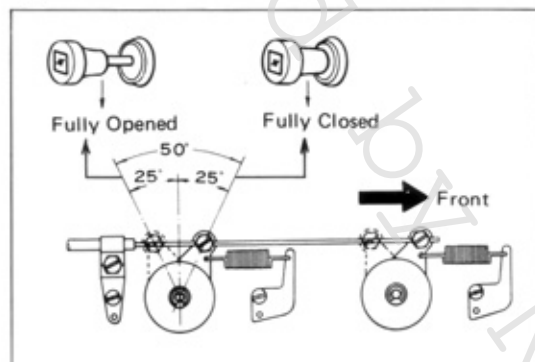
3. Check the fuel discharging time
0.8-1.1 second

Fig. 3-77



4. Check the fuel injection direction.

Fig. 3-78



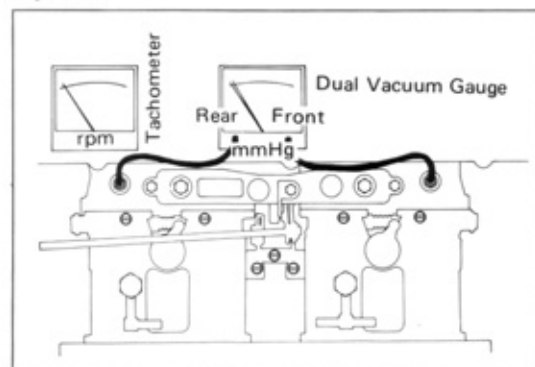
STARTER WIRE

THROTTLE LINK (INITIAL IDLE SPEED) INSPECTION

Check the following items beforehand.

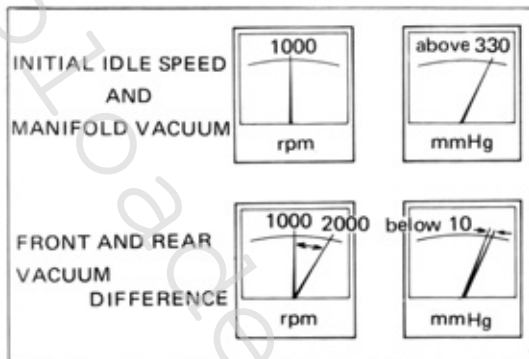
1. Coolant temperature 80°C (180°F)
2. Accessory parts All switched off.

Fig. 3-79



3. Mount the tachometer and the dual vacuum gauge to the vacuum take-off connection on the No. 1 and No. 4 intake manifolds.

Fig. 3-80



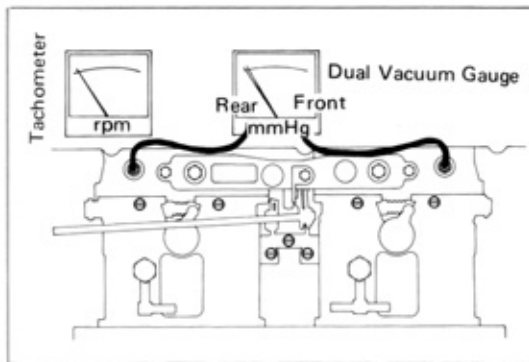
4. Check the idle speed and the difference between front and rear manifold vacuum.
- Idle speed** **1000 ± 50rpm**
- Manifold Vacuum** **330mmHg (13.00inHg)**
- Front and Rear Vacuum Difference (idle to 2000 rpm)** **below 10mmHg (0.39inHg)**

ADJUSTMENT

Check the following items beforehand.

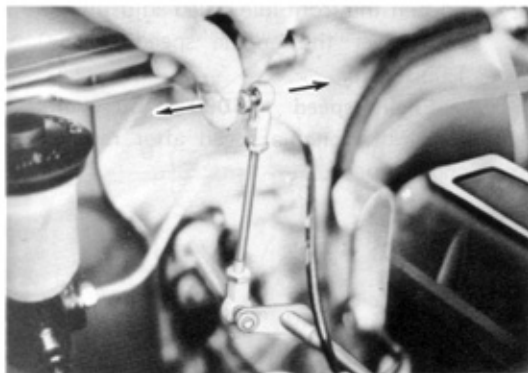
1. Coolant temperature 80°C (180°F)
2. Accessory parts All switched off.

Fig. 3-81



3. Mount the tachometer and the dual vacuum gauge to the vacuum take-off connection on the No. 1 and No. 4 intake manifolds.

Fig. 3-82



4. Disconnect the connecting rod at the body.

Fig. 3-83

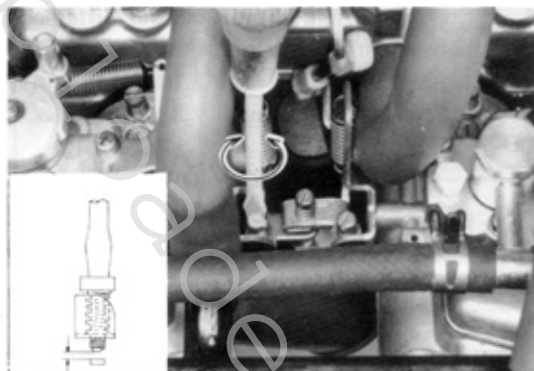


Fig. 3-84

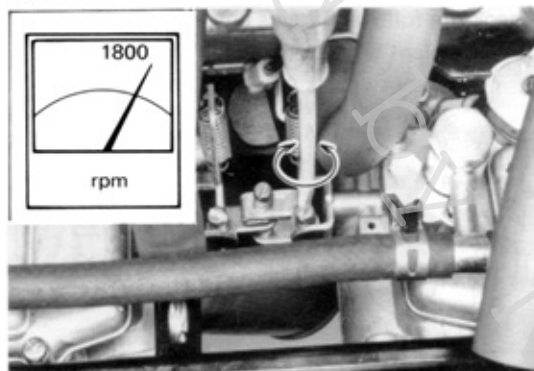


Fig. 3-85

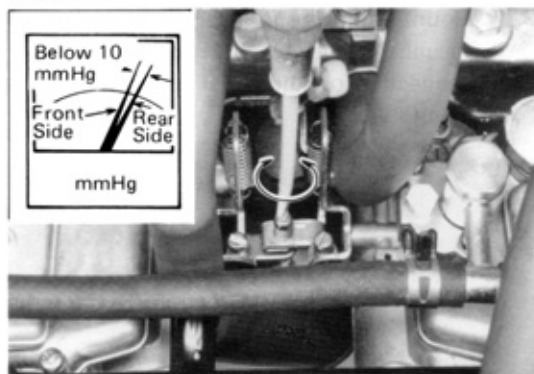
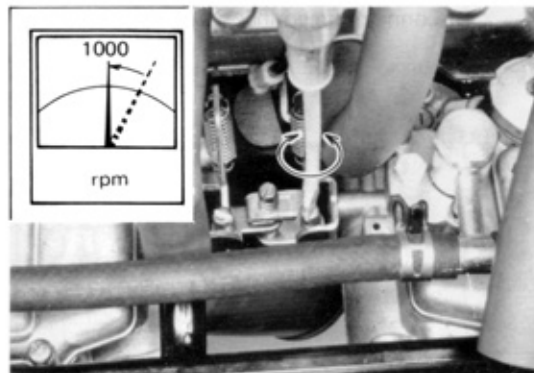


Fig. 3-86



5. Loosen the rear idle speed adjusting screw until it is free from the lever.

6. Set to 1800rpm by turning the front idle speed adjusting screw.

Engine speed 1800 rpm

Check the engine speed after raising the engine speed.

7. Set to front-rear vacuum difference to within 10mmHg (0.39inHg) by turning the synchronizing screw.

Front and rear vacuum difference below 10mmHg (0.39inHg)

Check the vacuum difference after raising the engine speed.

8. Loosen the front idle speed adjusting screw and lower the engine speed to 950 ~ 1,050 rpm.

Engine speed 1000 ± 50 rpm

Check the engine speed after raising the engine speed.

Fig. 3-87

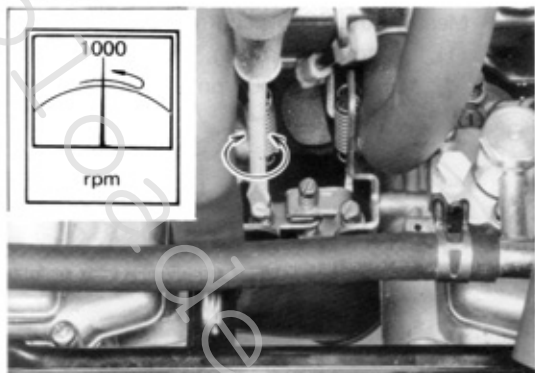


Fig. 3-88

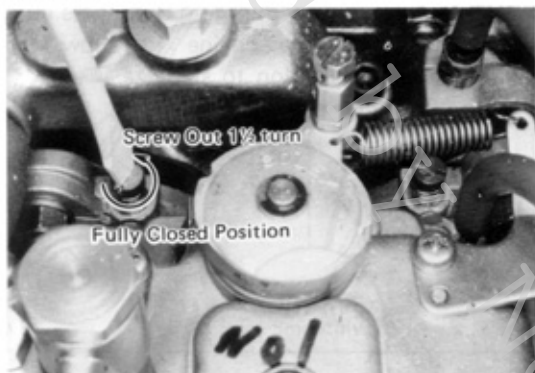


Fig. 3-89

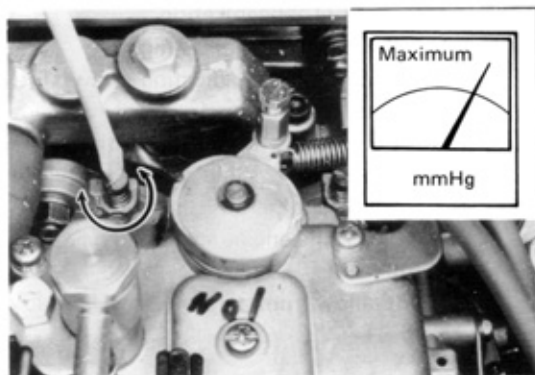
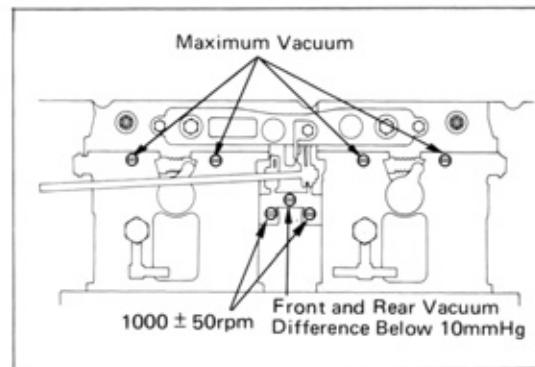


Fig. 3-90



9. Screw in the slightly the rear idle speed adjusting screw and raise the engine speed, then adjust the engine speed to 950 ~ 1050 rpm.

Engine speed 1000 ± 50rpm

Check the engine speed after raising the engine speed.

10. Readjust front-rear vacuum difference.

Below 10mmHg (0.39inHg)

BEST IDLE ADJUSTMENT

1. Screw out all of the idle mixture adjusting screws 1½ turn from fully closed position.

— Note —

Screw in gently until fully closed, taking care not to injure the carburetor idle port or the screw tapered point.

2. Set to the maximum vacuum reading by turning each idle mixture adjusting screw.

— Caution —

Repeat adjustment 2 or 3 times to obtain maximum vacuum setting.

Best idle speed 1000 rpm

Manifold vacuum Above 330mmHg (13.00inHg)

3. Readjust the following 2 or 3 times.

- (1) Idle speed adjusting screw

Idle speed 1000 ± 50rpm

- (2) Synchronizing screw (Idle to 2000rpm)

Front and rear vacuum difference

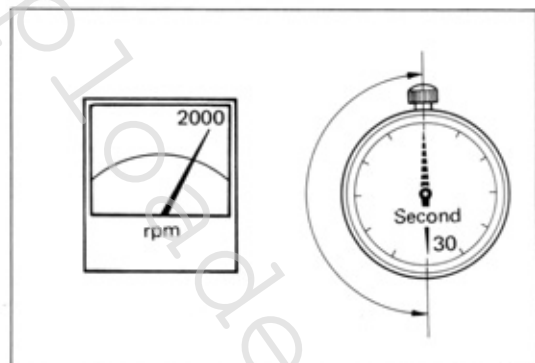
Below 10mmHg (0.39inHg)

- (3) Idle mixture adjusting screw

Manifold vacuum

Above 330mmHg (13.00inHg)

Fig. 3-91

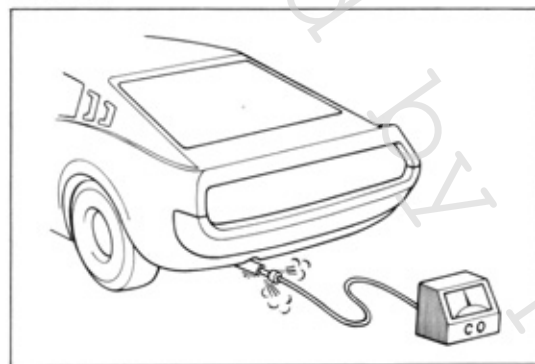


CO CONCENTRATION



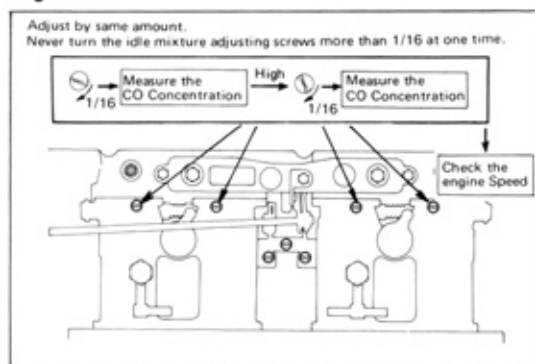
1. Measure the CO concentration
 - (1) Before measuring, race the engine at about 2,000 rpm for 30 – 60 seconds.

Fig. 3-92



- (2) Measure within 1 to 3 minutes after racing the engine to allow the concentration to stabilize.

Fig. 3-93



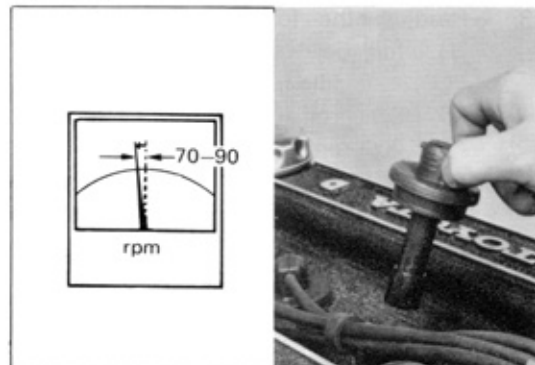
2. Adjust the CO concentration.
When the concentration is high:

- (1) 4 idle mixture adjusting screws 1/16 turn.
- (2) Measure the CO concentration again.
- (3) If still high, 4 idle mixture adjusting screws another 1/16 turn.
- (4) Check the engine speed.

— Note —

Do not allow rpm to be below best idle speed.

Fig. 3-94



3. Check rpm of each cylinder when if misfires.

Decrease in rpm approx. 70 – 90 rpm
All four cylinders should show same decrease.

- (1) When one plug misfires, raise rpm and clean.
- (2) When decrease in rpm is not uniform, adjust with the idle mixture adjusting screw.

Fig. 3-95

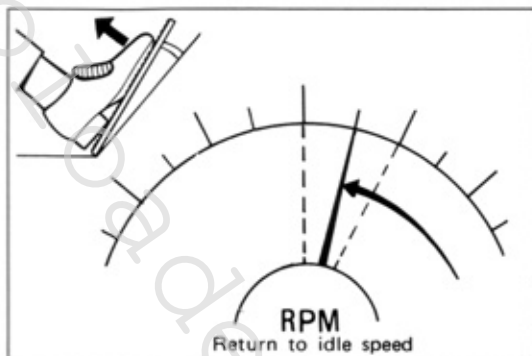


Fig. 3-96

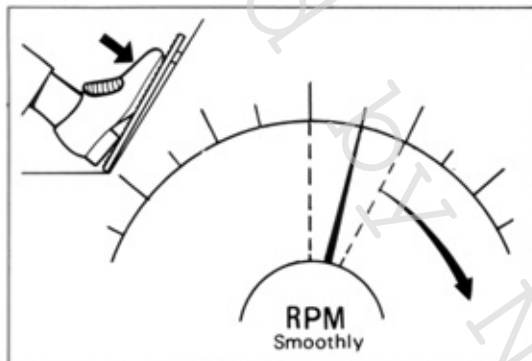
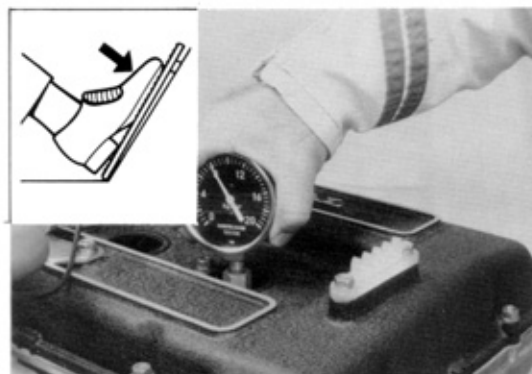


Fig. 3-97



Fig. 3-98



ENGINE CONDITION



1. Check if the engine returns to idle speed when both suddenly and slowly accelerated.



2. Opening throttle valve gradually should cause engine to speed up smoothly in relation to amount of valve opening.

COMPRESSION PRESSURE



1. Warm up the engine.
2. Remove all spark plugs.
3. Disconnect the high tension cord from ignition coil to cut-off the secondary circuit.



4. Insert a compression gauge into the spark plug hole, open the throttle valve fully, and measure the compression pressure while cranking the engine with starter motor.

Compression Pressure (at 200 rpm)

STD 13.0kg/cm² (184.6psi)

Limit 10.0kg/cm² (142.0psi)

Difference of pressure between cylinders Less than 1.0kg/cm² (14.2psi)

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18R ENGINE SERVICE

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| CUTAWAY VIEW | 4-2 |
| CYLINDER HEAD | |
| Includes: Cylinder Head, Valve and Spring Rocker Arm, Camshaft, Manifold | |
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| TIMING GEAR | |
| Includes: Timing Gear, Chain, Damper and Slipper Pump Drive Shaft and Bearing, Front Oil Seal | |
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| CYLINDER BLOCK | |
| Includes: Cylinder Block, Piston and Connecting Rod Piston Ring Crank pin and Bearing, Crankshaft and Bearing Flywheel, Rear Oil Seal Input Shaft Bearing | |
| DISASSEMBLY | 4-34 |
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CUTAWAY VIEW

Fig. 4-1

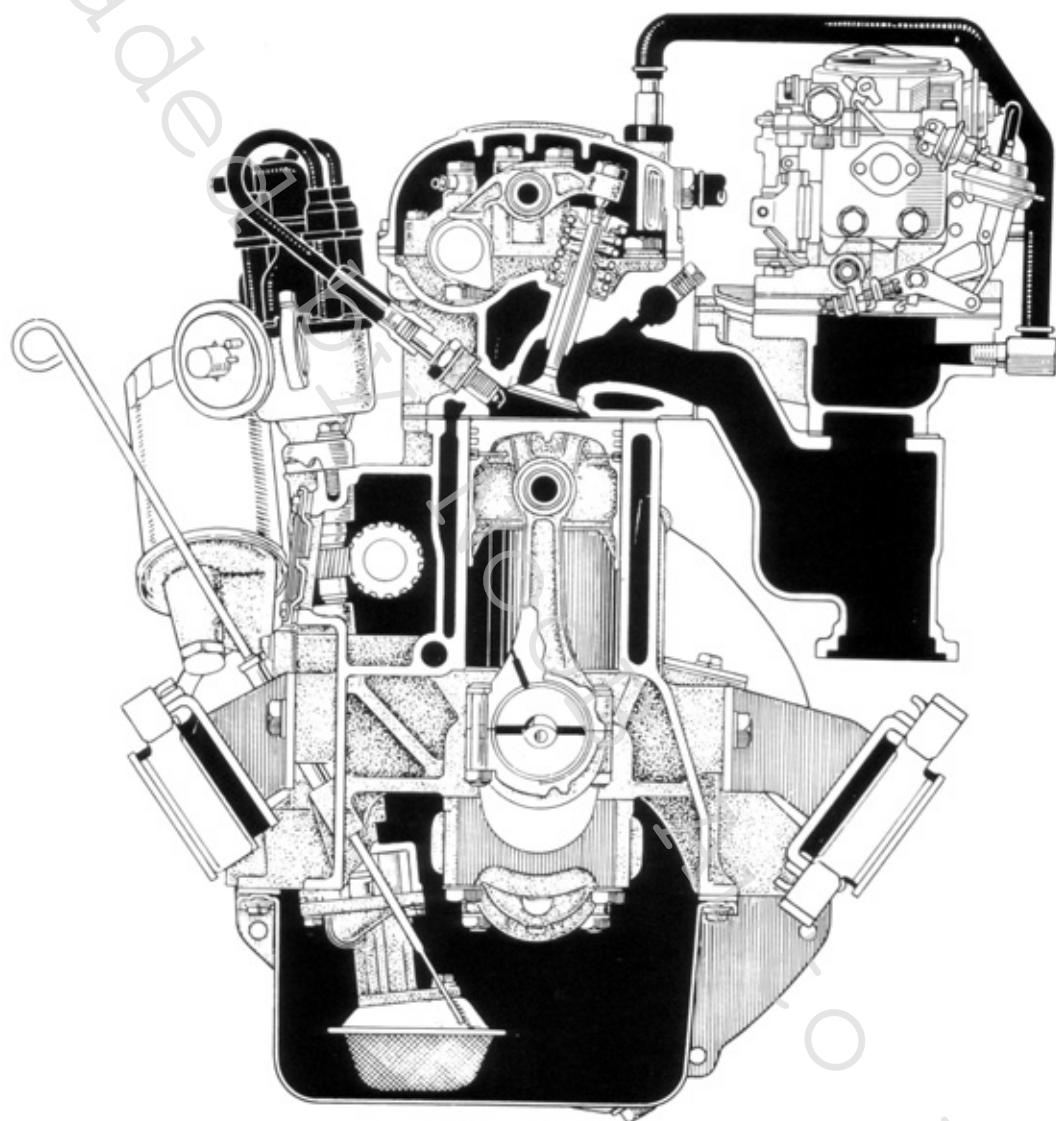
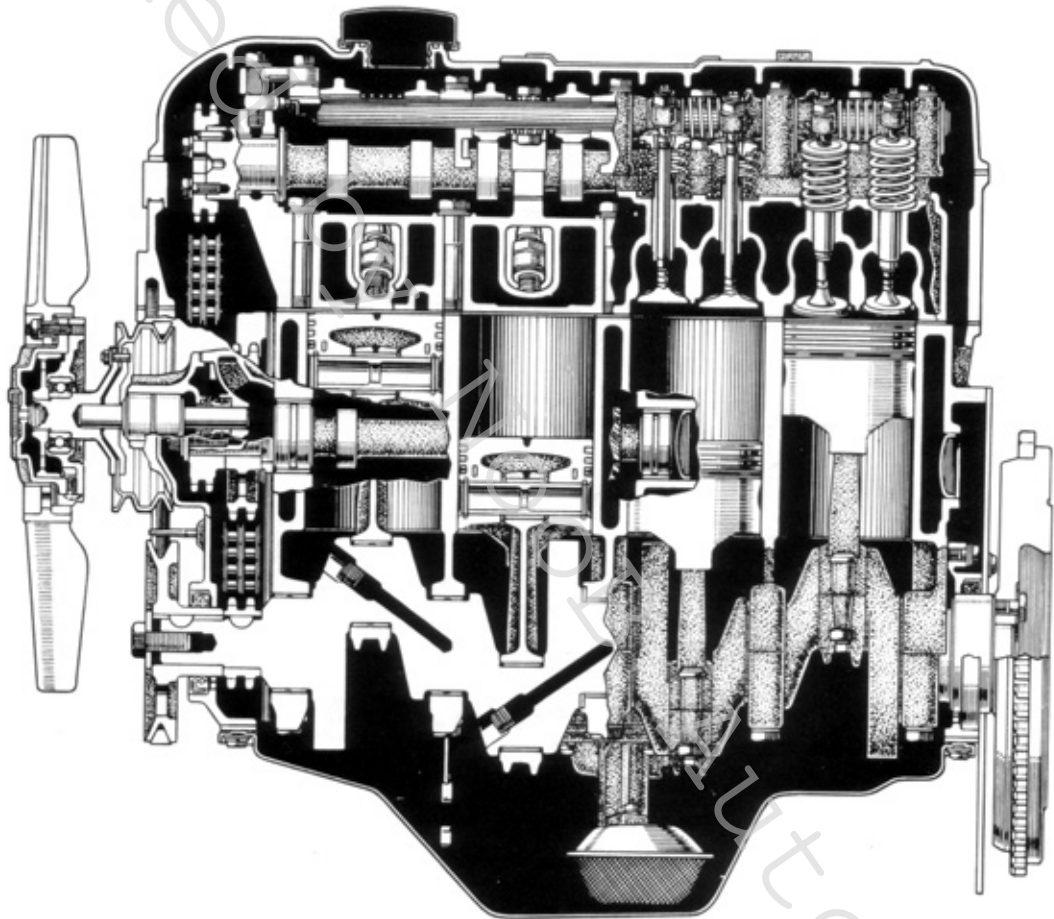


Fig. 4-2



CYLINDER HEAD DISASSEMBLY

Disassemble in numerical order.

Fig. 4-3

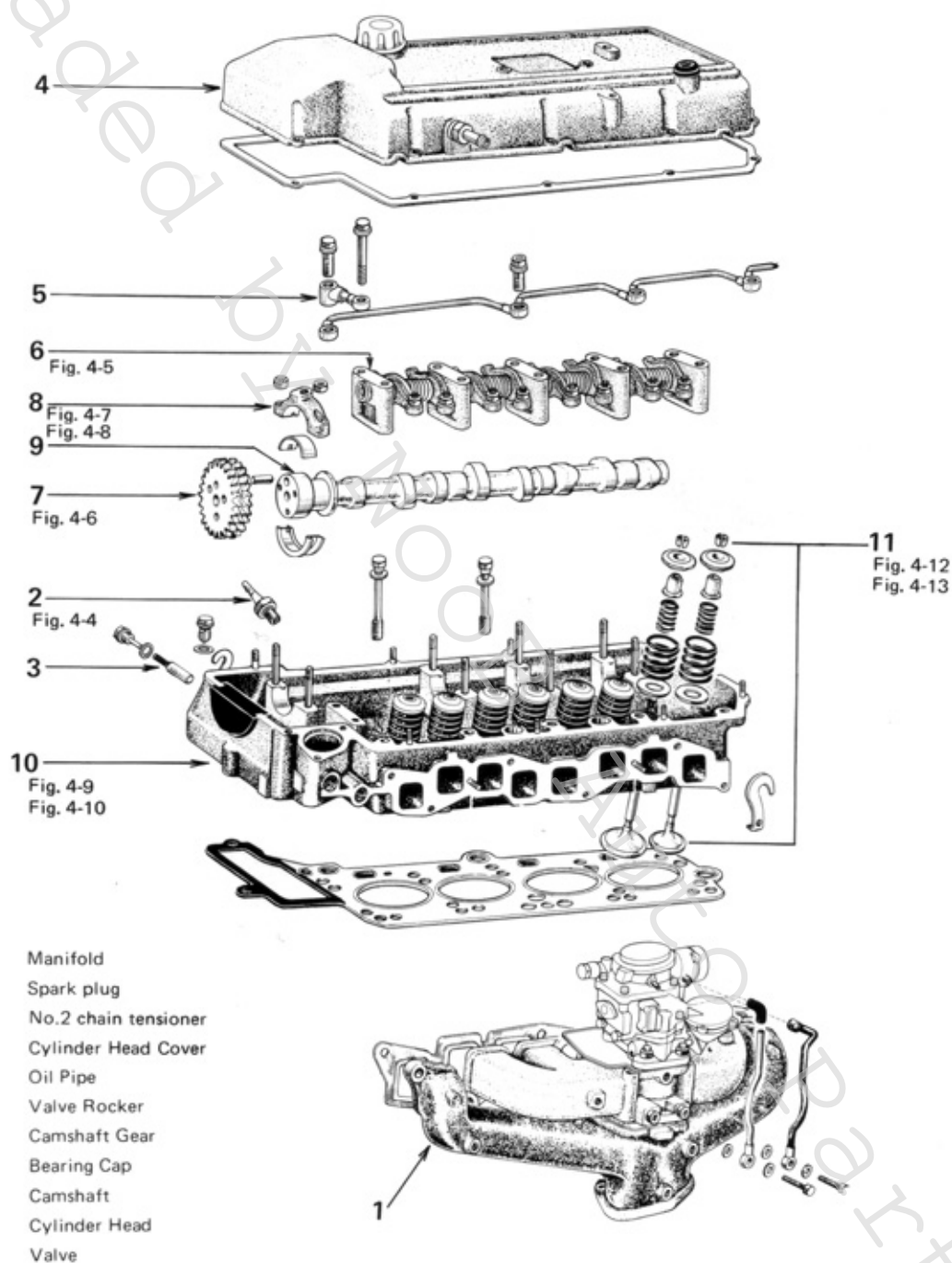
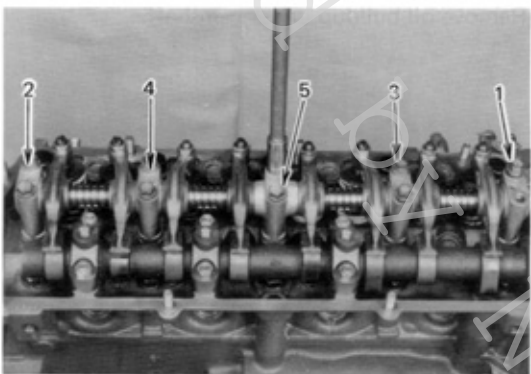


Fig. 4-4



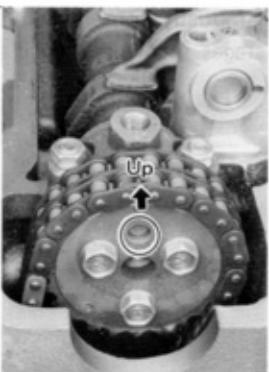
Remove carefully plug cords by pulling rubber boot.

Fig. 4-5



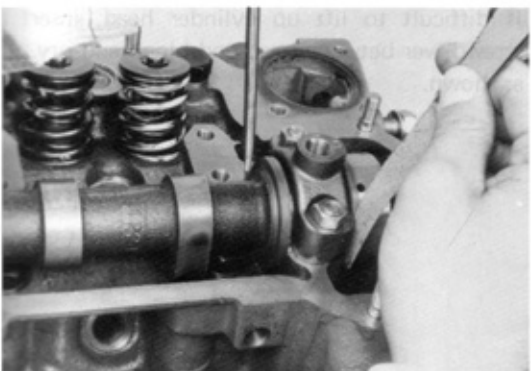
Gradually loosen rocker support bolts in 2 to 3 stages in the sequence as shown.

Fig. 4-6



Set No. 1 cylinder to TDC/compression.
Camshaft knock pin should point up.

Fig. 4-7



Measure camshaft thrust clearance.

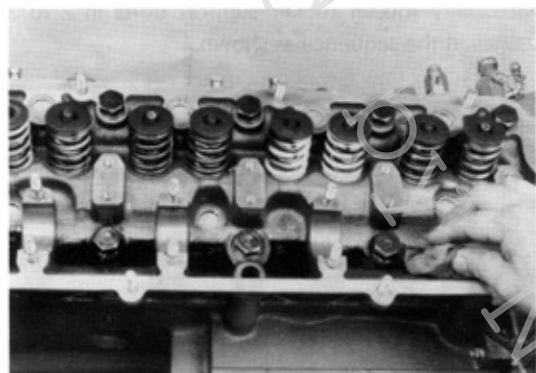
Thrust clearance limit 0.25 mm
(0.0098 in)

Fig. 4-8



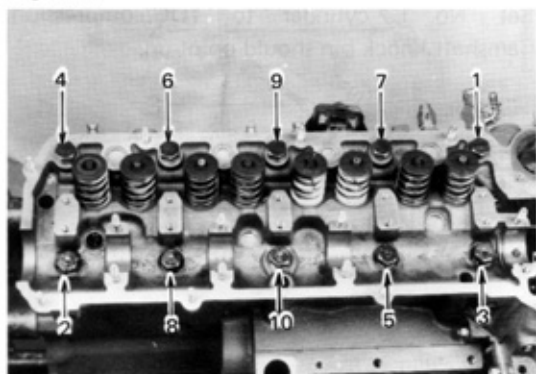
Keep camshaft bearing cap and bearing in order.

Fig. 4-9



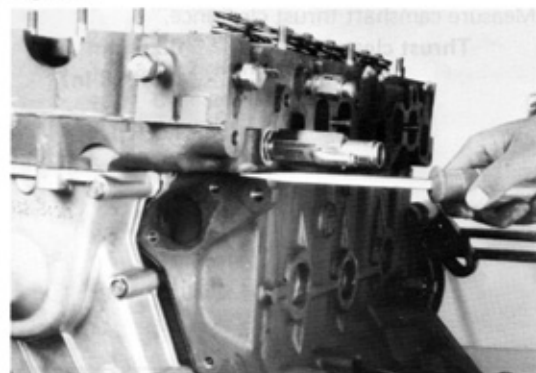
Remove oil buildup under camshaft.

Fig. 4-10



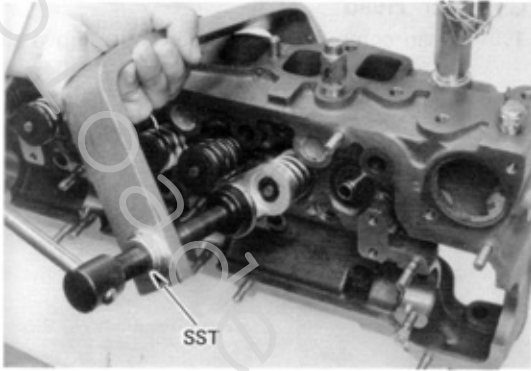
Gradually loosen cylinder head bolts in 2 to 3 stages in the sequence as shown.

Fig. 4-11



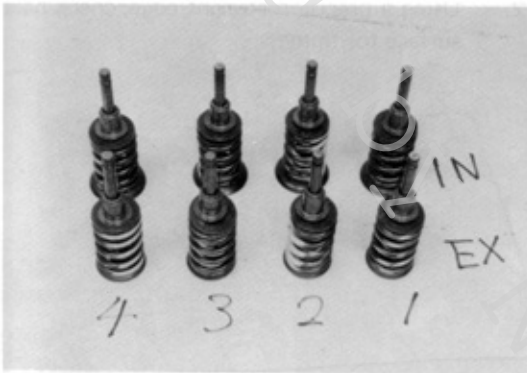
If difficult to lift up cylinder head, insert a screwdriver between head and block and pry off as shown.

Fig. 4-12



Compress the valve spring with SST [09202-43011].

Fig. 4-13



Keep valve and oil seal in order.

Fig. 4-15

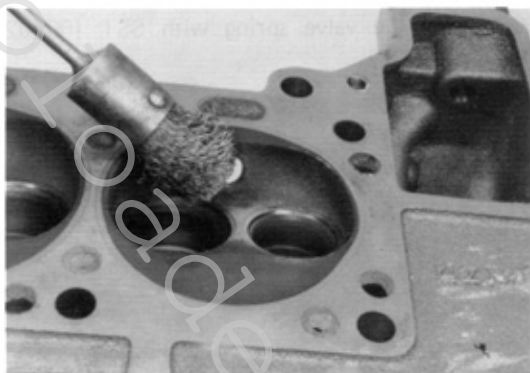


Fig. 4-16

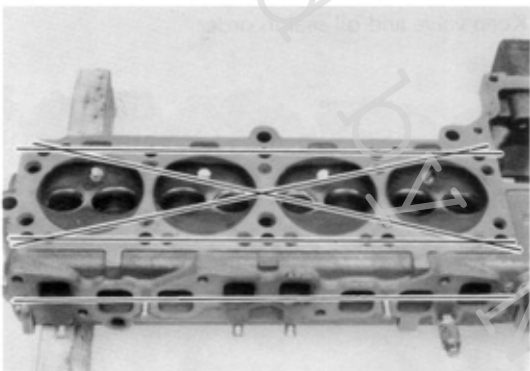


Fig. 4-17

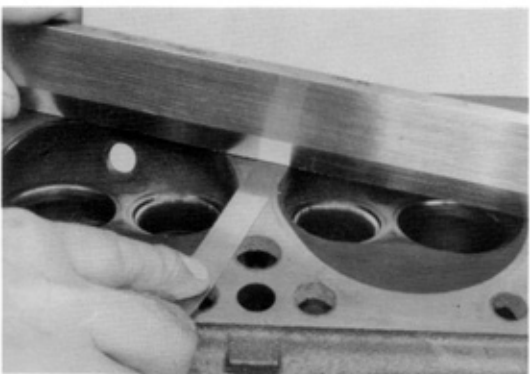
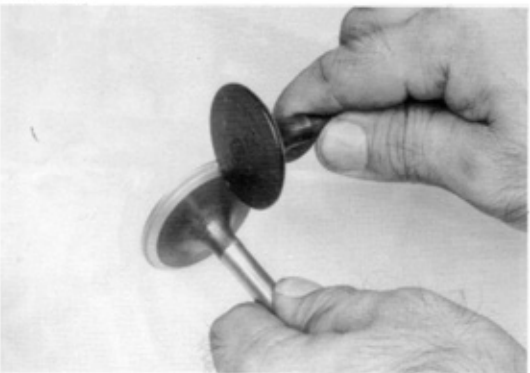


Fig. 4-18



INSPECTION & REPAIR

Cylinder Head



1. Clean combustion chamber and remove all gasket material from manifold and head surface.



2. Using a precision straight edge, check head surface for flatness.



3. If warpage exceeds limit,, correct by machining or replace head.

Head surface warpage limit

0.05 mm (0.0019 in)

Maximum reface limit

0.2 mm (0.0079 in)



Valve, Guide and Seat

1. Clean valves.

Fig. 4-19

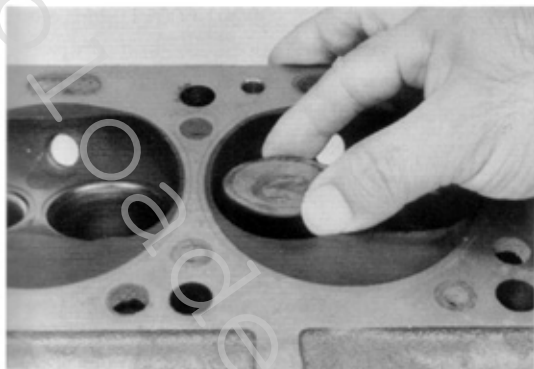


Fig. 4-20



Fig. 4-21

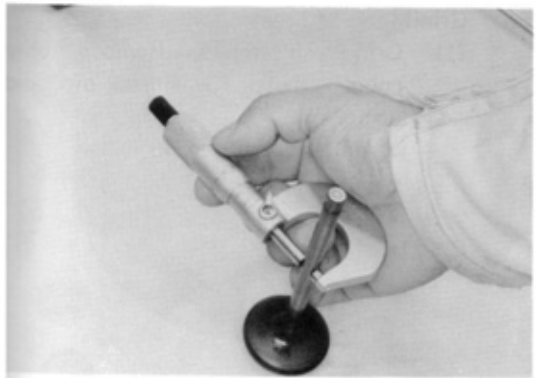
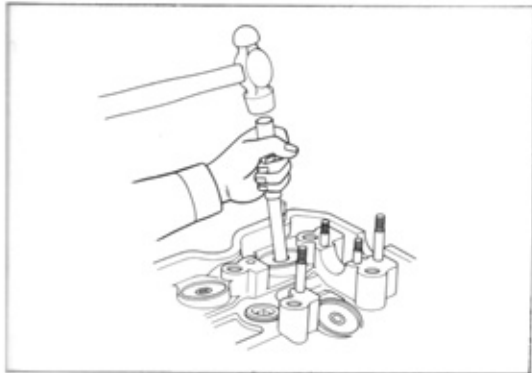


Fig. 4-22



2. Quick-check valve stem and guide wear by inserting correct valve in guide and moving valve as shown.



3. Measure valve stem oil clearance
 - (1) Measure inside diameter of valve guide.



- (2) Measure valve stem diameter.
- (3) Subtract stem measurement.

Clearance limit

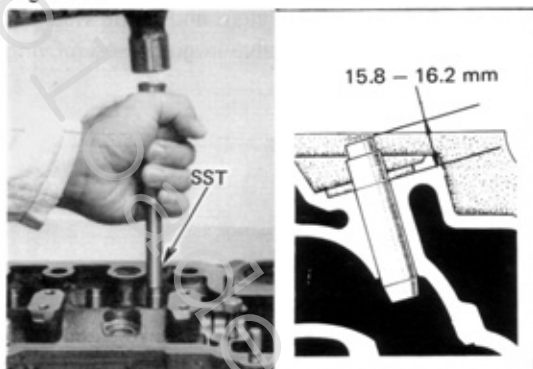
| | | |
|----------------|----------------|------------------|
| Intake | 0.08 mm | 0.0032 in |
| Exhaust | 0.10 mm | 0.0039 in |

Replace guide and valve if clearance exceeds limit.



4. Replace guide
 - (1) Drive out guide from the top end toward the combustion chamber, use SST [09201-60011].

Fig. 4-23

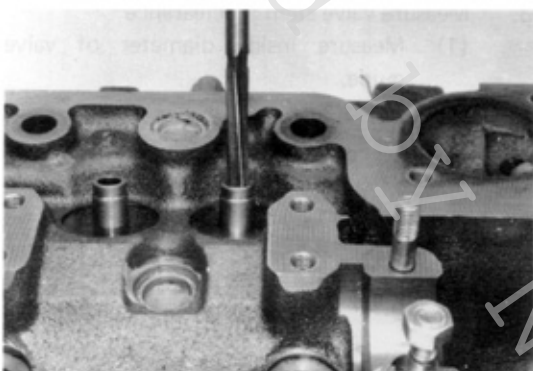


- (2) Using SST [09201-60011], drive in new guide until its end projects from cylinder head the distance noted below.

Projection distance

15.8–16.2 mm
(0.622–0.638 in)

Fig. 4-24

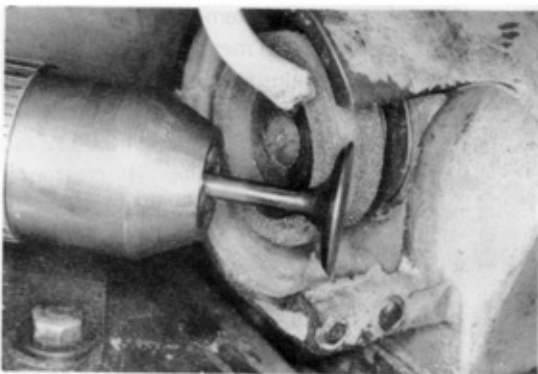


- (3) Using a sharp 8 mm reamer, ream guide to obtain specified clearance.

Intake 0.03–0.06 mm
(0.0012–0.0024 in)

Exhaust 0.04–0.08 mm
(0.0016–0.0032 in)

Fig. 4-25

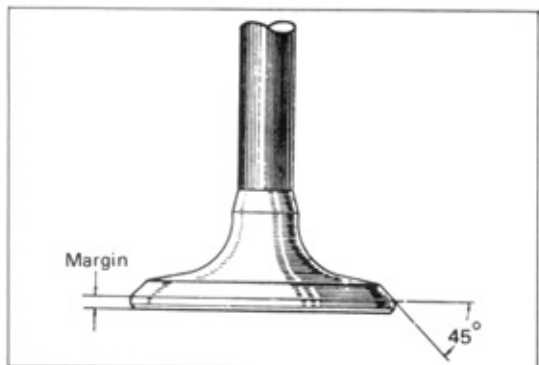


5. Grind valve and seat

- (1) Grind all valves. Remove only enough metal to remove pits and carbon.

Valve face angle : 45°

Fig. 4-26



- (2) Check margin.

If valve head margin is less than specification, replace valve.

Margin limit

Intake 0.6 mm (0.024 in)

Exhaust 0.6 mm (0.024 in)

Fig. 4-27

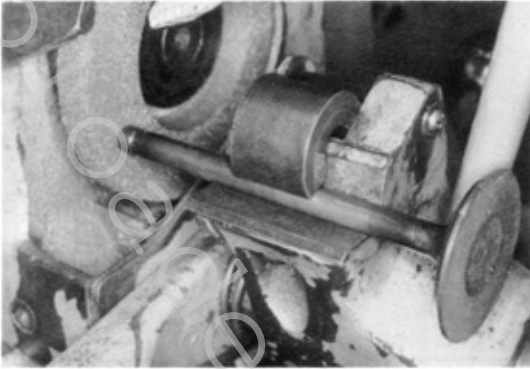


Fig. 4-28

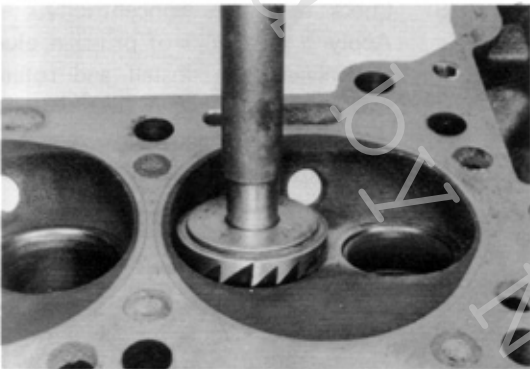


Fig. 4-29

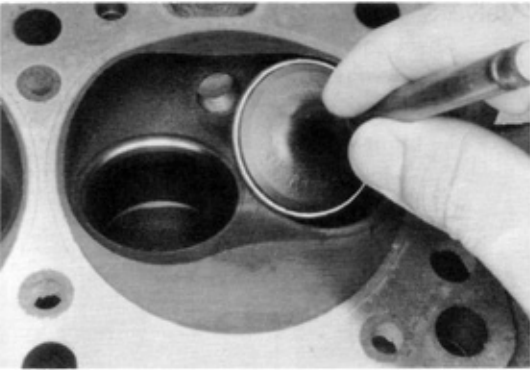
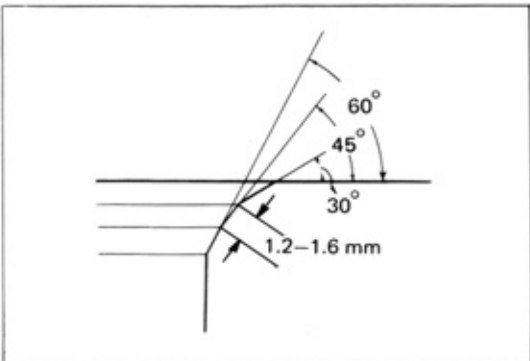


Fig. 4-30



- (3) If valve stem tip has been worn by rocker arm, resurface with valve grinder.
Do not grind more than 0.5 mm (0.02 in).

**Overall length limit 112.7 mm
(4.437 in)**

- (4) Resurface valve seats with 45° carbide cutter.
Remove only enough metal to clean seat.

- (5) Coat valve face with prussian blue or white lead. Locate contact point on valve by rotating valve against seat.

— Note —

Seat contact should be in middle of valve face with following width:

Intake 1.2–1.6 mm (0.047–0.063 in)

Exhaust 1.2–1.6 mm (0.047–0.063 in)

- (6) Correct seat position.
To correct seating that is too high, use 30° and 45° cutters. If seating is too low, use 65° and 45° cutters.

Fig. 4-31

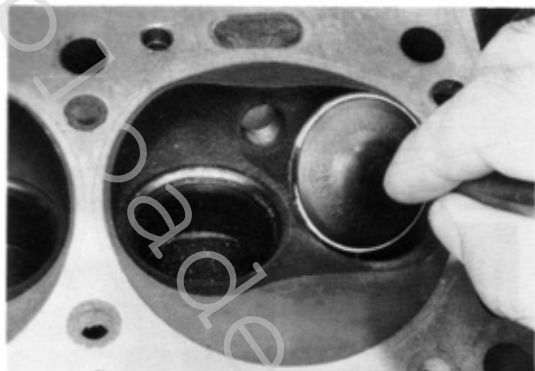


Fig. 4-32

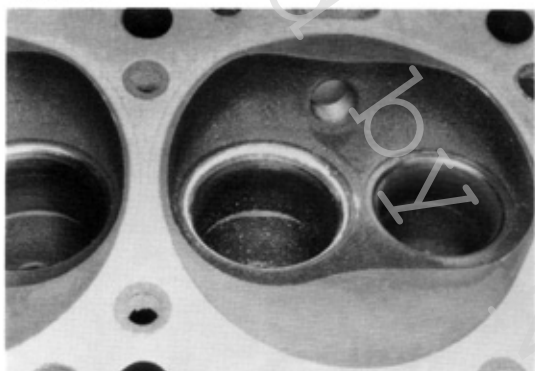


Fig. 4-33

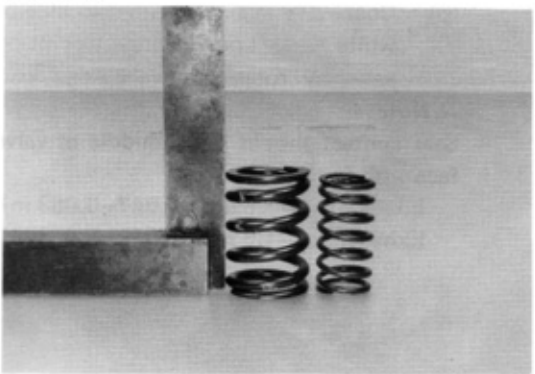
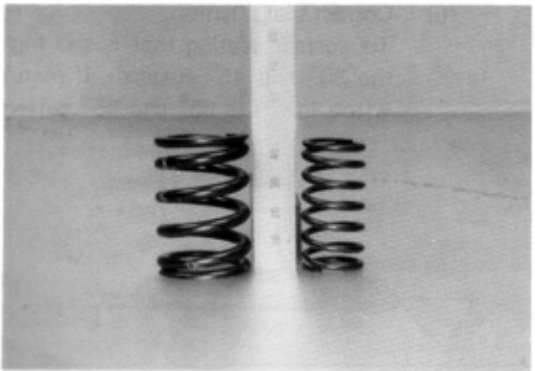


Fig. 4-34



- (7) Check valve concentricity. Lightly coat seat with prussian blue. Install valve and rotate. If blue appears 360° around face, valve stem and face are concentric. If not, replace valve.

- (8) Check seat/guide concentricity. Apply a light coat of prussian blue on valve face. Install and rotate valve. If blue appears 360° around valve seat, guide and seat are concentric. If not, recut seat.



Valve Spring

1. Check squareness of valve springs with steel square. If spring is out of square more than limit, replace.

Limit

| | |
|-------|-------------------|
| Inner | 1.6 mm (0.063 in) |
| Outer | 1.9 mm (0.075 in) |

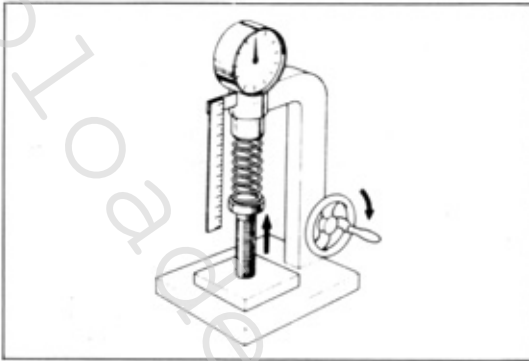


2. Measure free height of all springs. Replace any spring that is out of specification.

Free height

| | |
|-------|--------------------|
| Inner | 44.1 mm (1.736 in) |
| Outer | 46.5 mm (1.830 in) |

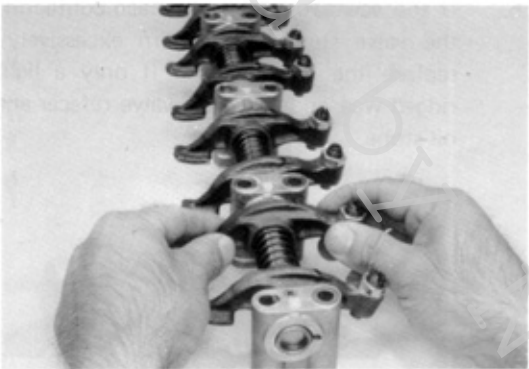
Fig. 4-35



3. Using a spring tester, measure tension of each spring at the specified installed height. Replace any spring that does not meet specification.

| | Inner | Outer |
|----------|----------------------|-----------------------|
| Limit | 6.0 kg (13.23 lb) | 19.0 kg (41.89 lb) |
| Standard | 6.9 kg (15.21 lb) | 23.0 kg (50.71 lb) |

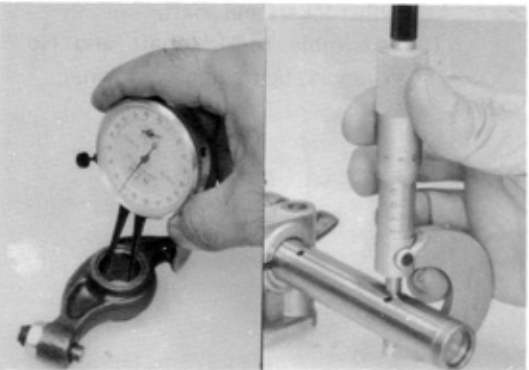
Fig. 4-36



Rocker Arm and Shaft

1. Check rocker arm to shaft clearance by moving rocker arm as shown. Little or no movement should be indicated. If movement is felt, disassemble and inspect.

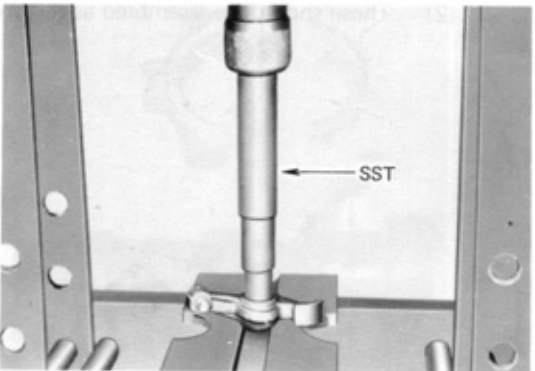
Fig. 4-37



2. If movement was felt above, measure rocker oil clearance with dial indicator and outside micrometer. If clearance is excessive, replace rocker arm bushings and/or shaft.

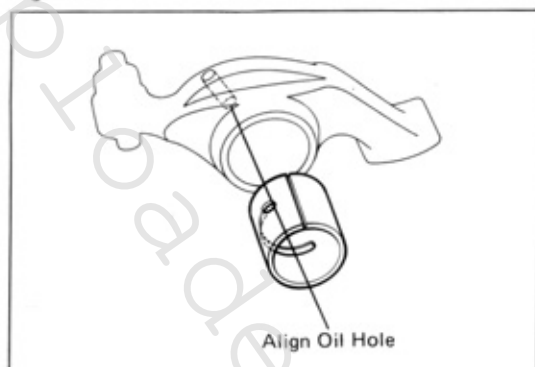
| | |
|-----------------|------------------------------------|
| Clearance Limit | 0.08 mm (0.0032 in) |
| Standard | 0.02–0.05 mm (0.0008–0.0020 in) |

Fig. 4-38



3. To remove the rocker arm bushing, use SST [09222-30010].

Fig. 4-39



4. When assembling bushing, align oil hole with that of the rocker arm. After assembling, ream bushing to obtain specified oil clearance.

Standard **0.02–0.05 mm**
 (0.0008–0.0020 in)

Fig. 4-40



Fig. 4-41

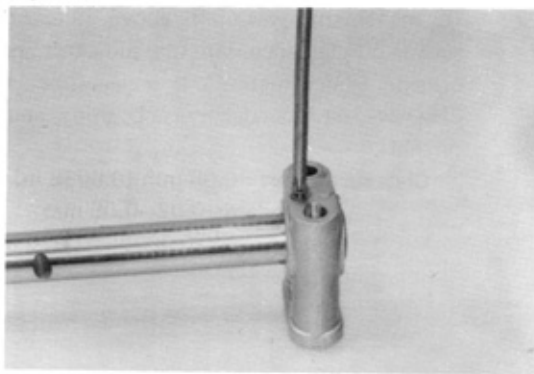
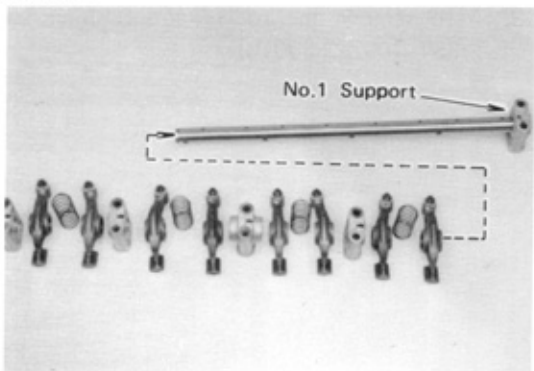


Fig. 4-42



5. If the valve rocker arm surface contacting the valve stem end is worn excessively, replace the rocker arm. If only a light ridged wear, correct with valve refacer and oil stone.



6. Assemble rockers and shaft.
 (1) Assemble rocker shaft and No. 1 support, tightening as shown.



- (2) These should be assembled as shown.

Fig. 4-43

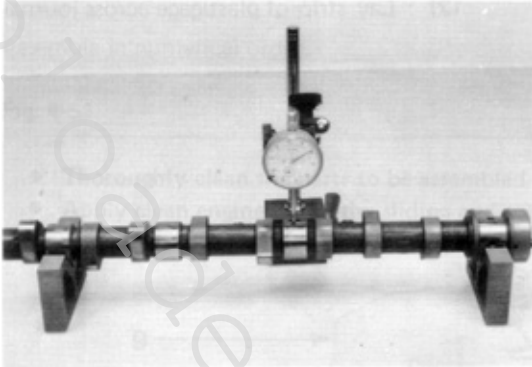


Fig. 4-44

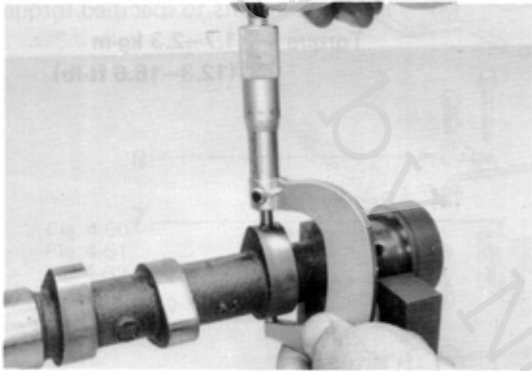


Fig. 4-45

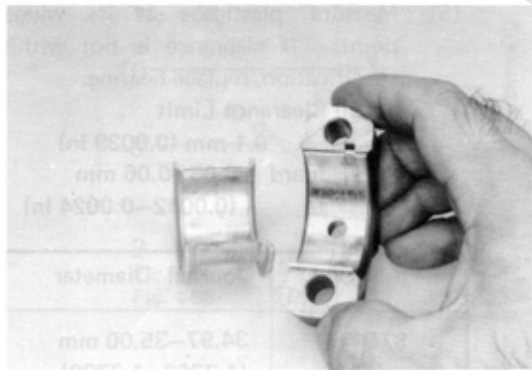
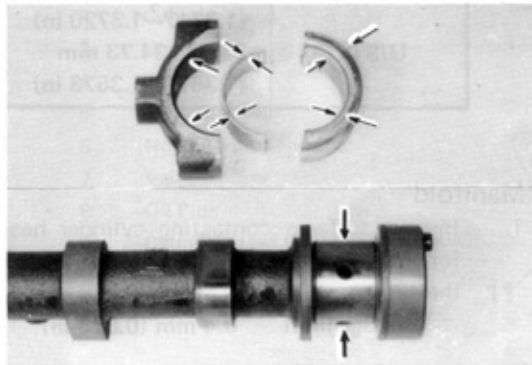


Fig. 4-46

**Camshaft and Bearing**

1. Check camshaft for runout and if it exceeds limit replace.

Runout limit **0.1 mm 0.004 in**



2. Measure cam lobe height. If wear exceeds limit, replace camshaft.

Height limit Intake **43.7 mm (1.720 in)**

Exhaust **43.8 mm (1.724 in)**

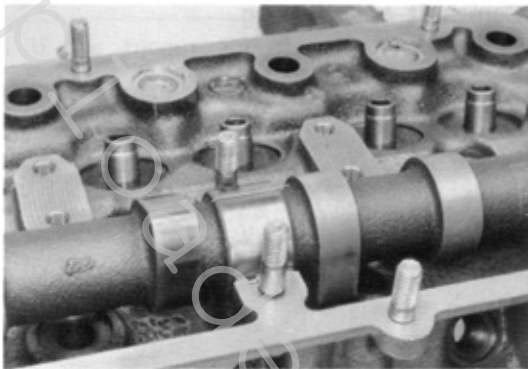


3. Check bearings for flaking or scoring. If bearings are damaged, replace.



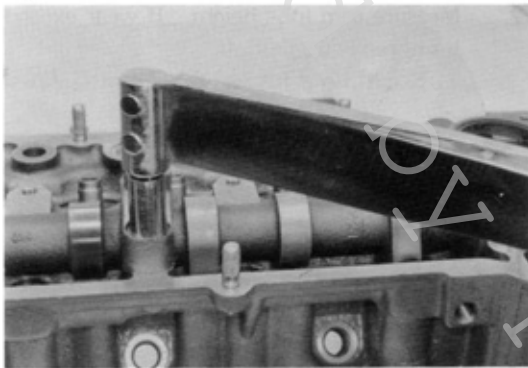
4. Measure camshaft oil clearance.
(1) Clean bearing, cap and camshaft journal.

Fig. 4-47



- (2) Lay strip of plastigage across journal.

Fig. 4-48

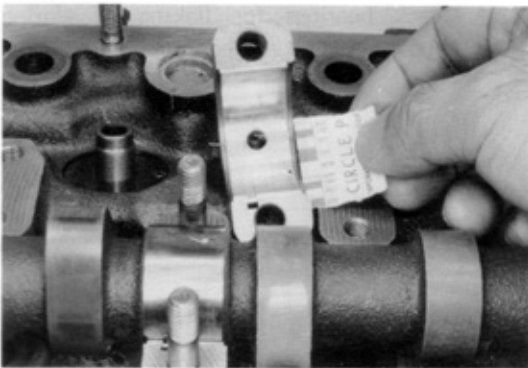


- (3) Tighten cap nuts to specified torque.

Torque 1.7–2.3 kg-m
(12.3–16.6 ft-lb)

- (4) Remove cap.

Fig. 4-49



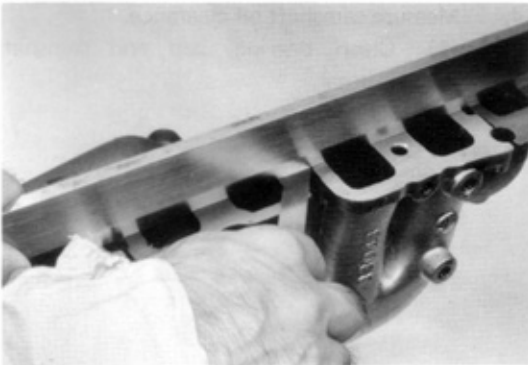
- (5) Measure plastigage at its widest point. If clearance is not within specification, replace bearing.

Oil Clearance Limit

0.1 mm (0.0039 in)

Standard 0.03–0.06 mm
(0.0012–0.0024 in)

Fig. 4-50



| Bearing Size | Journal Diameter |
|--------------|--------------------------------------|
| STD | 34.97–35.00 mm (1.3768–1.3780) |
| U/S 0.125 | 34.84–34.85 mm (1.3717–1.3720 in) |
| U/S 0.25 | 34.72–34.73 mm (1.3670–1.3673 in) |

Manifold

1. Inspect surfaces contacting cylinder head for warpage, and replace if warped over the limit.

Warpage limit 0.4 mm (0.016 in)

ASSEMBLY

Assemble in numerical order.

Fig. 4-51

- Thoroughly clean the parts to be assembled.
- Apply clean engine oil on the sliding and rotating surfaces of the parts before assembly.

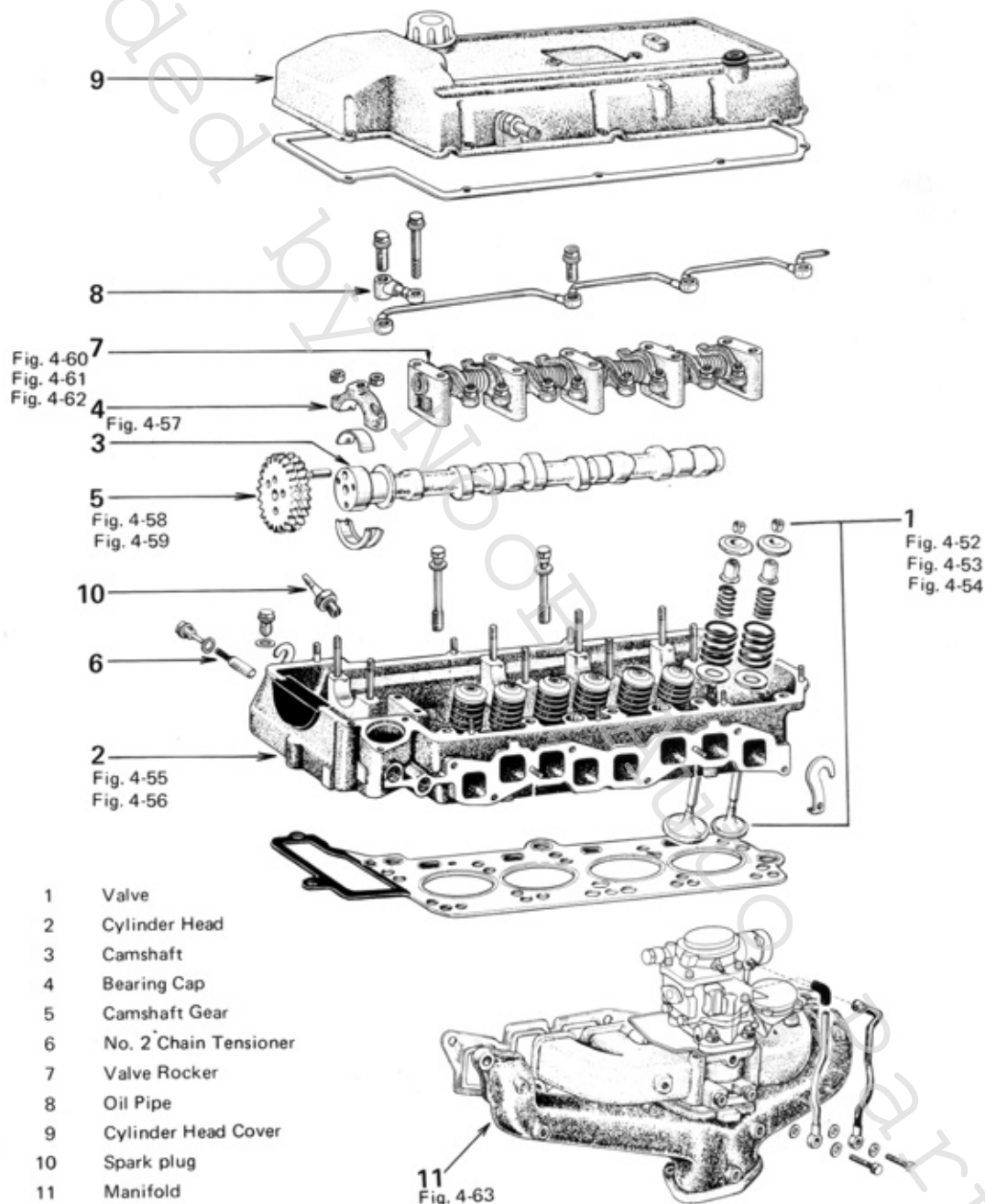
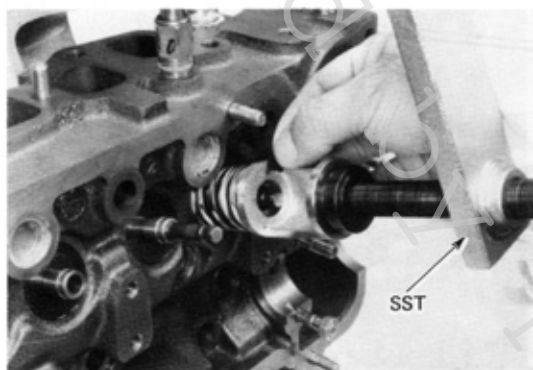


Fig. 4-52



Assemble spring seat and oil seal as shown. The oil seal should be inserted until its end contacts spring seat top.

Fig. 4-53



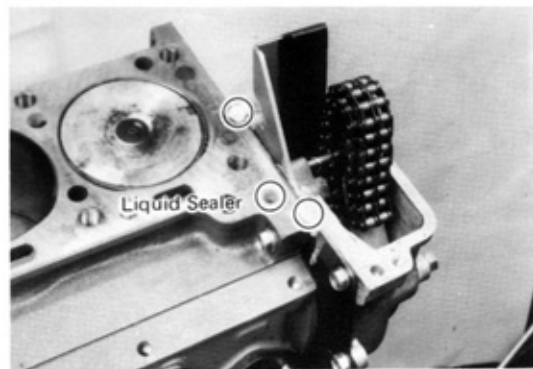
Compress the valve spring with SST [09202-43011] and install retainer locks.

Fig. 4-54



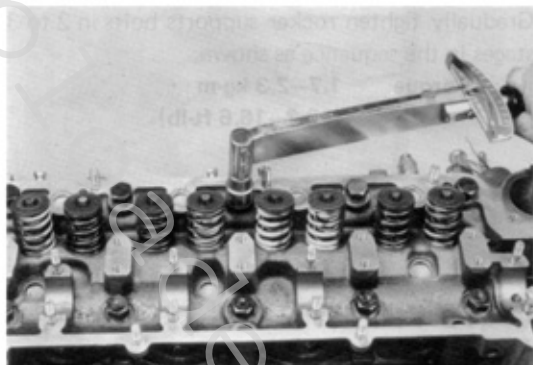
After assembling valve spring, tap stem lightly to assure proper fit.

Fig. 4-55



Apply liquid sealer on the cylinder head, around the oil holes in the block, and in the vicinity of the timing chain cover and cylinder block.

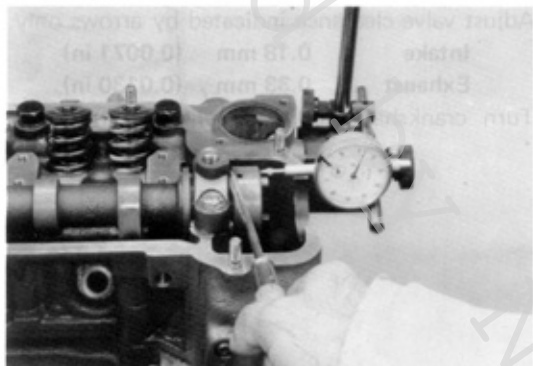
Fig. 4-56



Gradually tighten cylinder head bolts in 2 to 3 stages in the sequence as shown.

Torque 10–12 kg-m (72.3–86.8 ft-lb)

Fig. 4-57

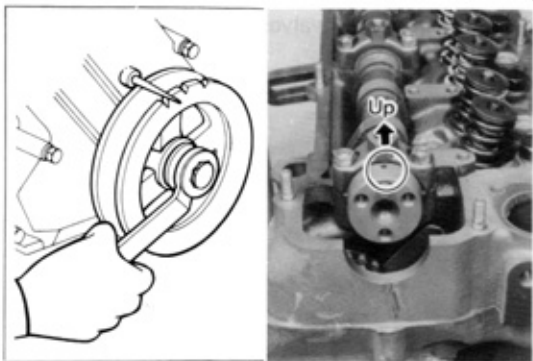


Make sure of camshaft thrust clearance.

Thrust Clearance Standard

0.15–0.30 mm (0.0059–0.0118 in)

Fig. 4-58



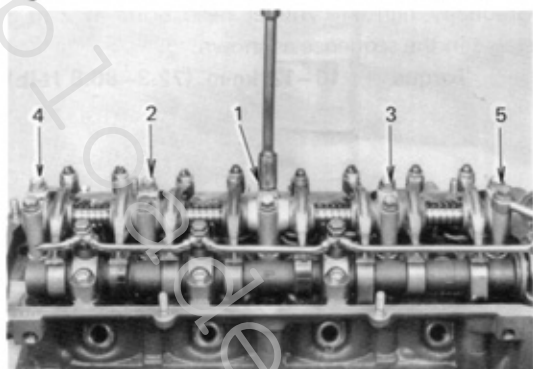
Set to No. 1 cylinder TDC/compression.
Camshaft knock pin should point up.

Fig. 4-59



Align chain and gear with marking made.
Install the No. 2 chain with it mark aligned with the gear mark.
Align gear pin hole and camshaft knock pin and install them.

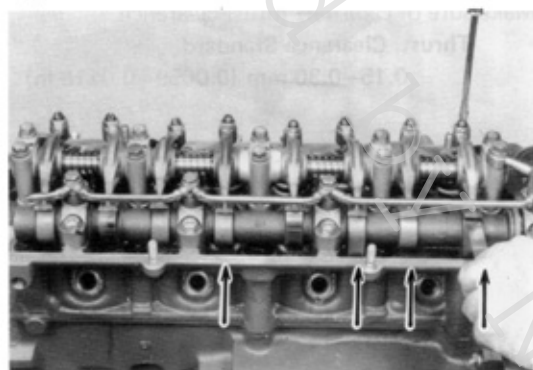
Fig. 4-60



Gradually tighten rocker supports bolts in 2 to 3 stages in the sequence as shown.

Torque 1.7–2.3 kg-m
(12.3–16.6 ft-lb)

Fig. 4-61



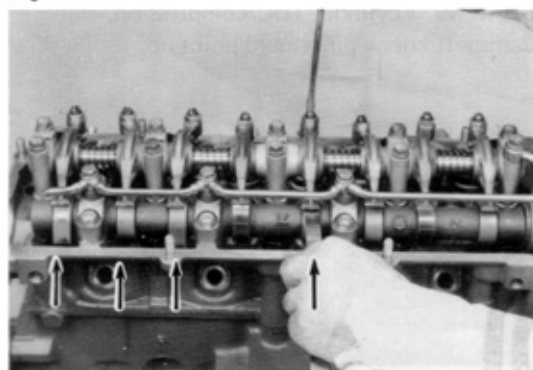
Adjust valve clearance indicated by arrows only.

Intake 0.18 mm (0.0071 in)

Exhaust 0.33 mm (0.0130 in)

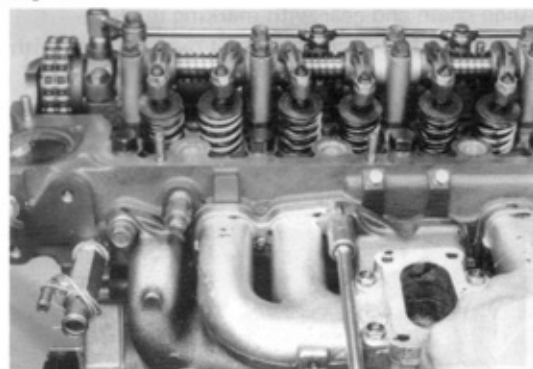
Turn crankshaft 360° and align timing mark.

Fig. 4-62



Adjust remaining valves indicated by arrows.

Fig. 4-63



Tighten the manifold securing nuts in the sequence as shown.

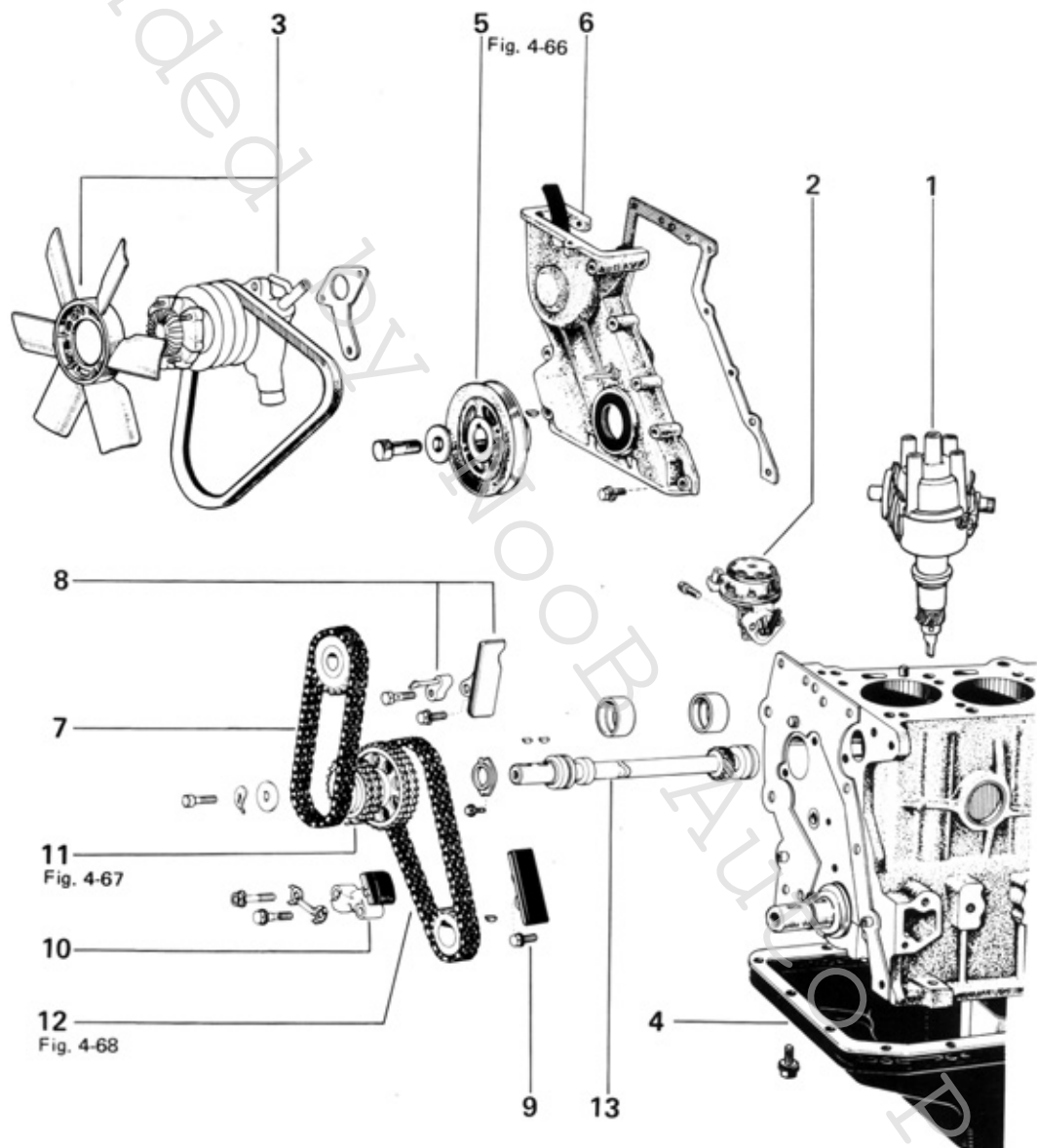
Torque 4.5–5.5 kg-m
(32.6–39.8 ft-lb)

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TIMING CHAIN DISASSEMBLY

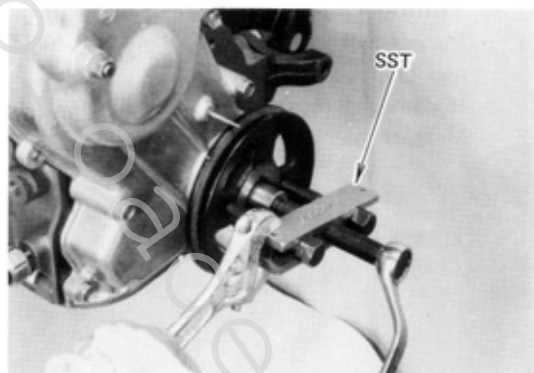
Disassemble in numerical order.

Fig. 4-65



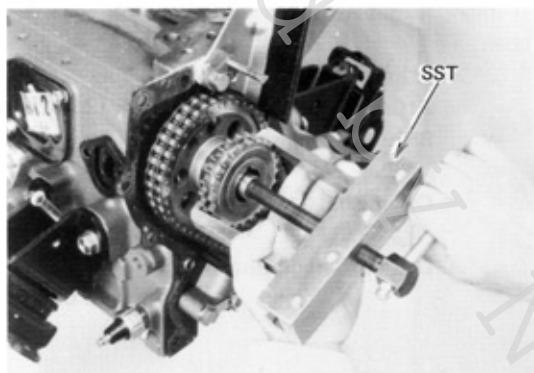
- | | | | | | |
|---|--------------------|---|--------------------|----|-----------------------------|
| 1 | Distributor | 5 | Crankshaft Pulley | 9 | No. 1 Chain Damper |
| 2 | Fuel Pump | 6 | Timing Gear Cover | 10 | No. 1 Chain Tensioner |
| 3 | Fan and Water Pump | 7 | No. 2 Timing Chain | 11 | Camshaft Drive Gear |
| 4 | Oil Pan | 8 | No. 2 Chain Damper | 12 | No. 1 Timing Chain and Gear |
| | | | and Oil Jet | 13 | Pump Drive Shaft |

Fig. 4-66



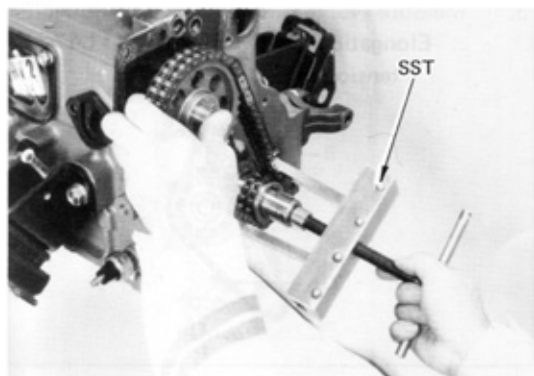
Pull out crankshaft pulley.
Use SST [09213-31021].

Fig. 4-67



Pull out camshaft drive gear.
Use SST [09213-36010].

Fig. 4-68



When removing these gears, hook the SST [09213-36010] alternately on the two gears and pull them out uniformly.

Fig. 4-70

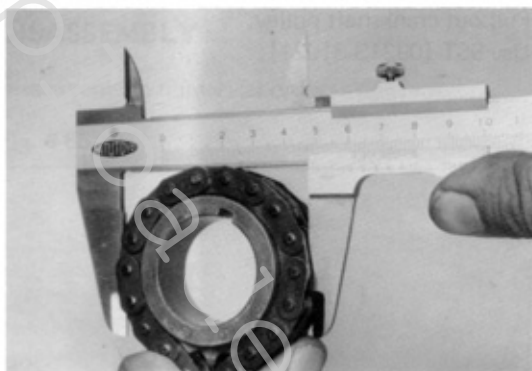


Fig. 4-71

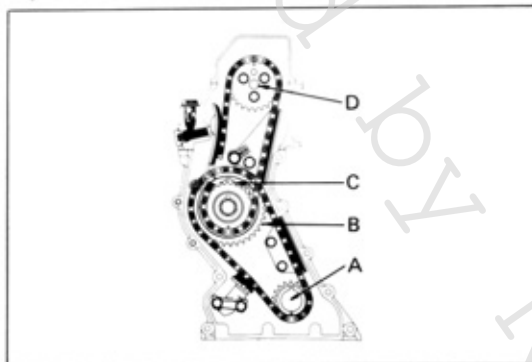


Fig. 4-72

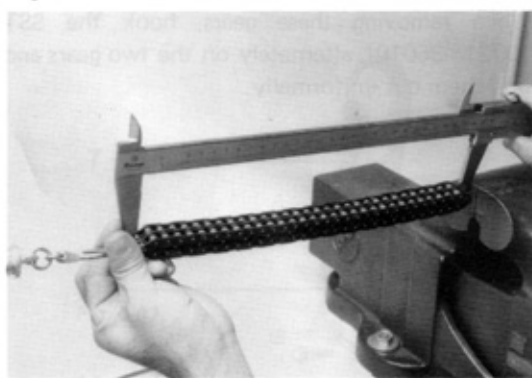
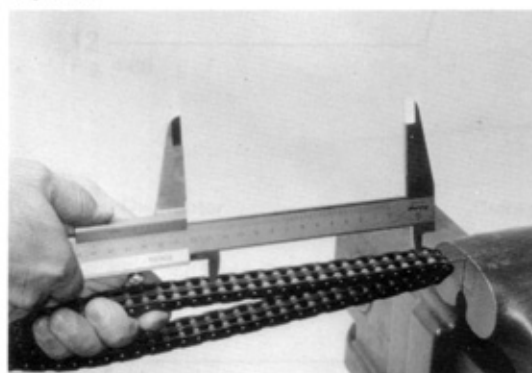


Fig. 4-73



INSPECTION AND REPAIR

Timing Gear and Chain



1. Inspect gear and chain for cracks, wear, and chipped teeth.
If damaged replace gears and chain.
2. Measure gear for wear as shown.



If measurement is below limit, replace gears and chain.

Wear limit

A: Crank shaft gear 60.0 mm (2.362 in)

B: Pump drive shaft gear
114.5 mm (4.508 in)

C: Camshaft drive gear
78.2 mm (3.079 in)

D: Camshaft timing gear
78.2 mm (3.079 in)



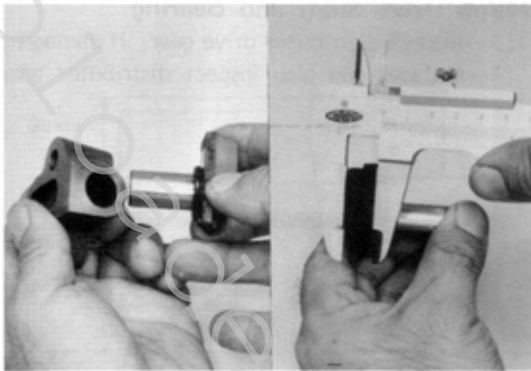
3. Measure No. 1 timing chain for elongation.
Elongation limit 291.4 mm (11.47 in)
tension at 5kg (11 lb)



4. Measure No. 2 timing chain for elongation. Measure the length of 17 links with the chain stretched tight with the force of one hand. Make the same measurements at more than three other places selected at random.
If over the limit at any one place, replace the chain.

Elongation limit (at 17 links)
147 mm (5.787 in)

Fig. 4-74

**No. 1 Chain Tensioner**

Inspect body and plunger for wear.

Measure tensioner head as shown.

If worn below limit, replace unit.

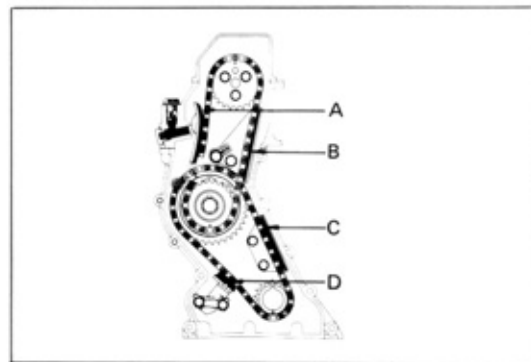
**Wear limit 11.5 mm (0.453 in)**

Fig. 4-75

**Chain Damper and Slipper**

Inspect chain dampers for wear. Measure each damper.

Fig. 4-76



If either is visibly worn or measures less than limit, replace unit

Wear limit**A: Slipper**

6.8 mm (0.26 in)

B: No. 2 damper

5.0 mm (0.20 in)

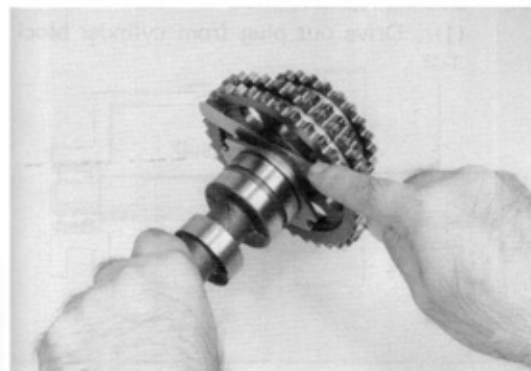
C: No. 1 damper

5.0 mm (0.20 in)

D: No. 1 tensioner

11.5 mm (0.45 in)

Fig. 4-77

**Timing Gear and Thrust Plate**

Measure thrust clearance.

If it exceeds limit, replace thrust plate.

Thrust clearance**limit 0.3 mm (0.012 in)****Standard**

0.06–0.13 mm (0.0024–0.0051 in)

Fig. 4-78

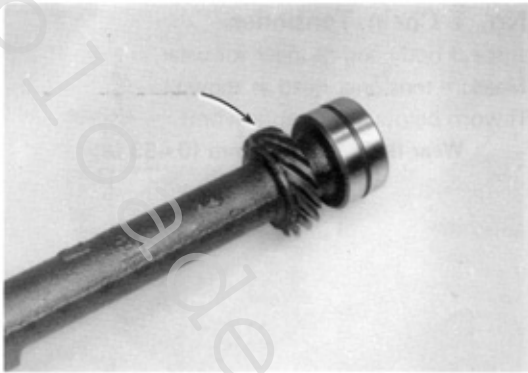


Fig. 4-79

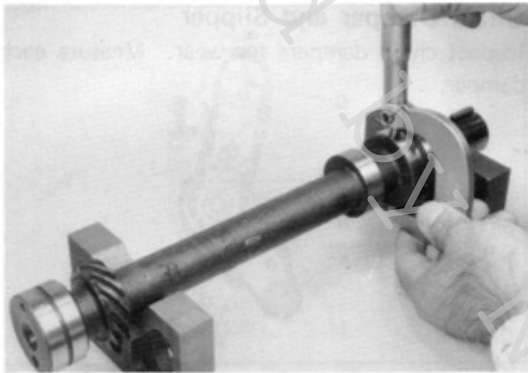


Fig. 4-80

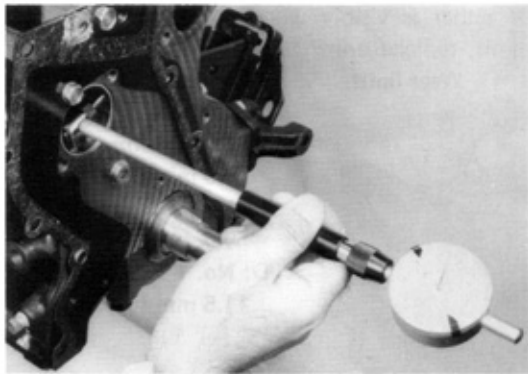
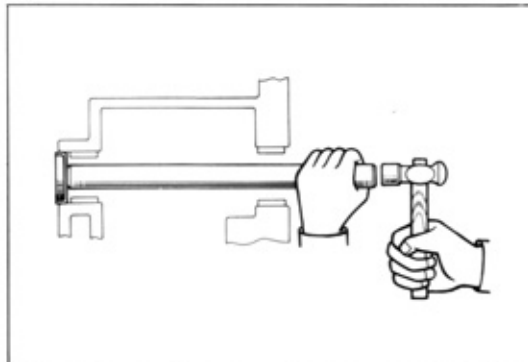


Fig. 4-81

**Pump Drive Shaft and Bearing**

1. Inspect distributor drive gear. If damaged, replace, and also inspect distributor gear.



2. Measure oil clearance
 - (1) Measure pump drive shaft journal.

Finished size

| | |
|--------------|--|
| Front | 45.96–45.98 mm (1.8098–1.8106 in) |
| Rear | 40.96–40.98 mm (1.6126–1.6134 in) |



- (2) Measure inner diameter of bearing.

Oil clearance limit

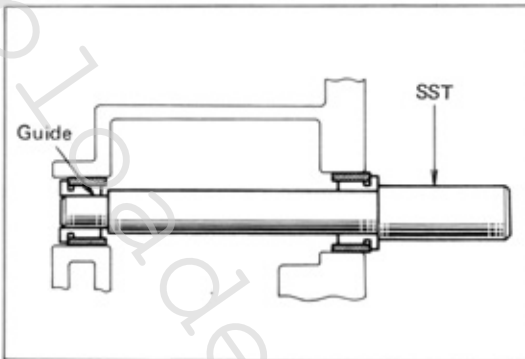
0.08 mm (0.0032 in)

Standard0.03–0.07 mm
(0.0008–0.0024 in)

3. Bearing replacement

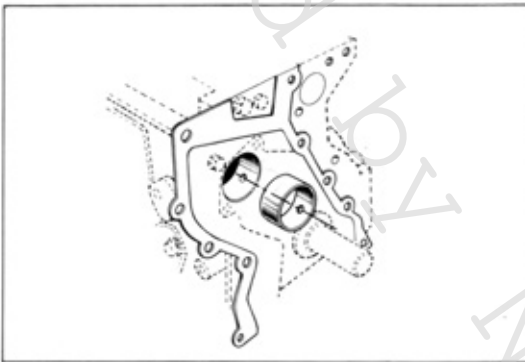
- (1) Drive out plug from cylinder block.

Fig. 4-82



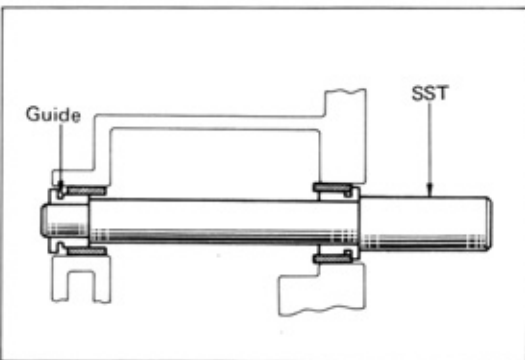
- (2) Remove front bearing.
Use SST [09233-33010] as shown.

Fig. 4-83



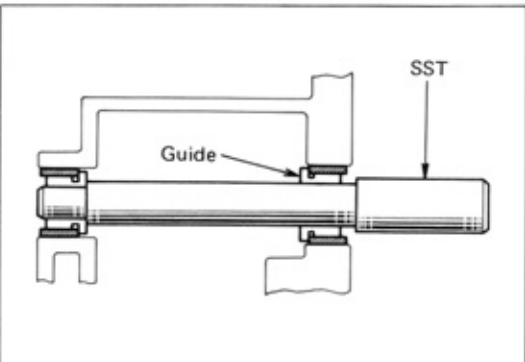
- (3) Align bearing oil hole.

Fig. 4-84



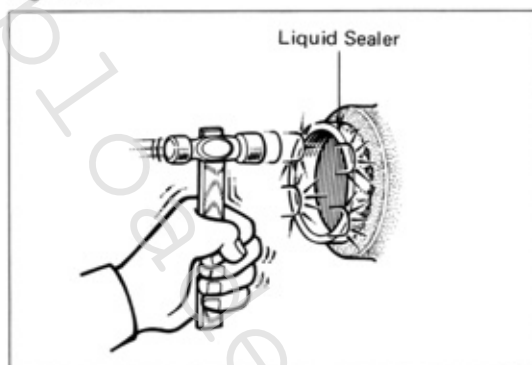
- (4) Install front bearing.
Use SST [09233-33010] as shown.
Bearing fitting tolerance
0.02–0.06 mm
(0.0008–0.0024 in)

Fig. 4-85



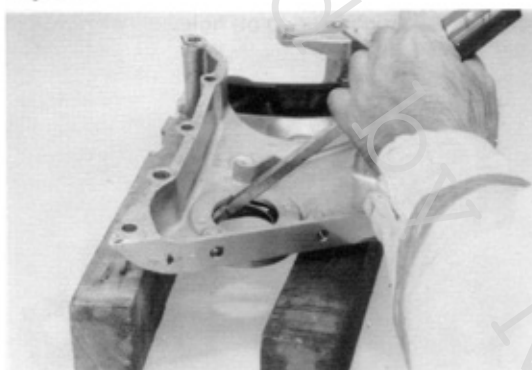
- (5) Remove rear bearing.
Replacement for rear bearing as same as front bearing.

Fig. 4-86



- (6) Install new plug applied with liquid sealer.

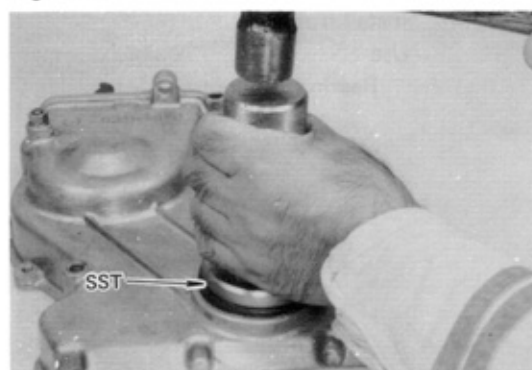
Fig. 4-87



Crankshaft Front Oil Seal Replacement

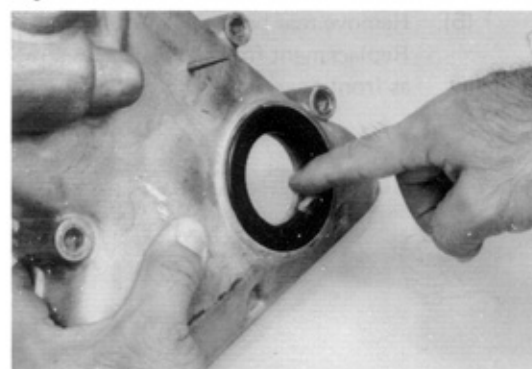
1. Remove oil seal with a screwdriver.

Fig. 4-88



2. Install new oil seal.
Use SST [09223-50010] as shown.

Fig. 4-89



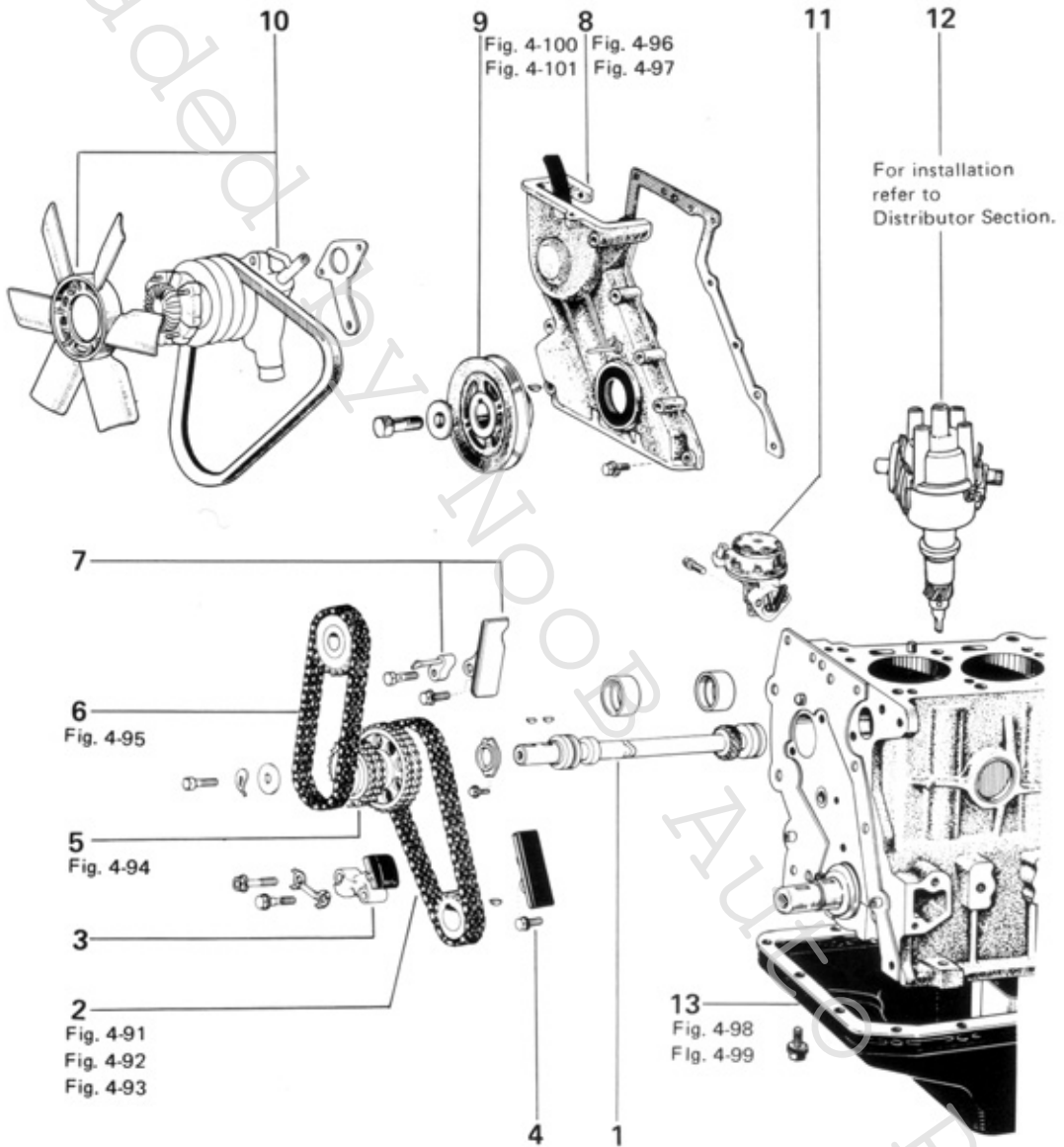
3. After driving in the seal, be sure to coat the seal lip lightly with MP grease.

ASSEMBLY

Assemble in numerical order.

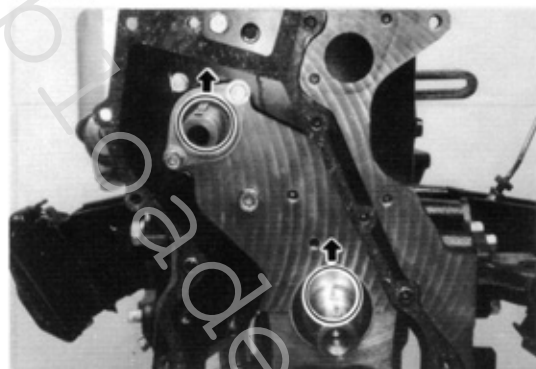
Fig. 4-90

- Thoroughly clean the parts to be assembled.
- Apply clean engine oil on the sliding and rotating surfaces of the parts before assembly.



- | | | | | | |
|---|-----------------------------|---|--------------------------------|----|--------------------|
| 1 | Pump Drive Shaft | 5 | Camshaft Drive Gear | 9 | Crankshaft Pulley |
| 2 | No. 2 Timing Chain and Gear | 6 | No. 2 Timing Chain | 10 | Fan and Water Pump |
| 3 | No. 1 Chain Tensioner | 7 | No. 2 Chain Damper and Oil Jet | 11 | Fuel Pump |
| 4 | No. 1 Chain Damper | 8 | Timing Gear Cover | 12 | Distributor |
| | | | | 13 | Oil Pan |

Fig. 4-91



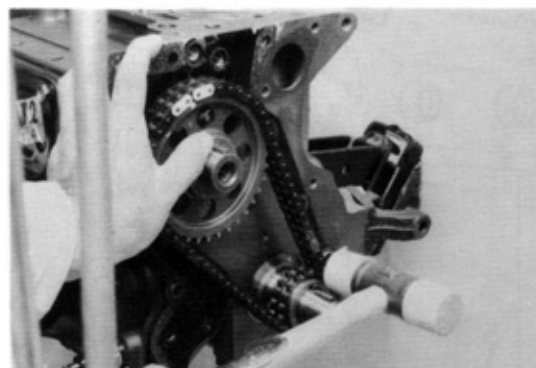
Set the crankshaft keyway and the pump drive shaft keyway vertically upward.

Fig. 4-92



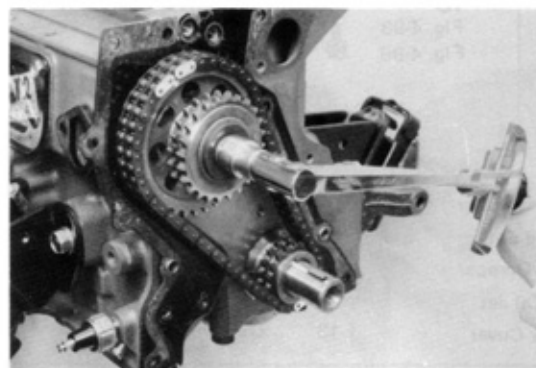
Assemble the crankshaft timing gear and pump drive shaft gear to the No. 2 chain so that their respective marks are aligned.

Fig. 4-93



Drive in No. 1 chain and gears on to the crankshaft and pump driveshaft.

Fig. 4-94



Tighten camshaft drive gear bolt.

Torque

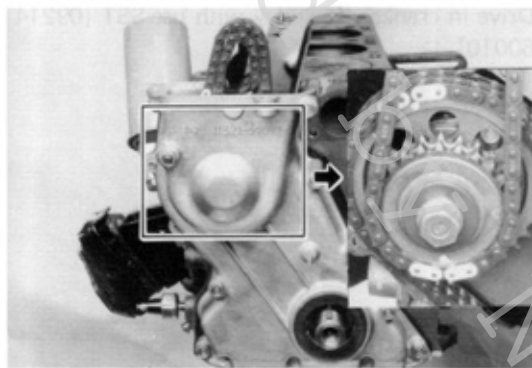
8.0–10.0 kg-m (57.9–72.3 ft-lb)

Fig. 4-95



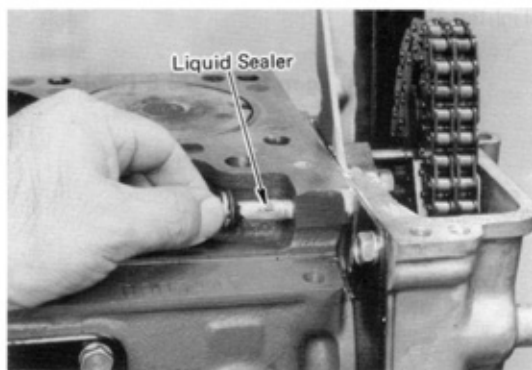
Install No. 2 chain aligned with the chain and gear marks.

Fig. 4-96



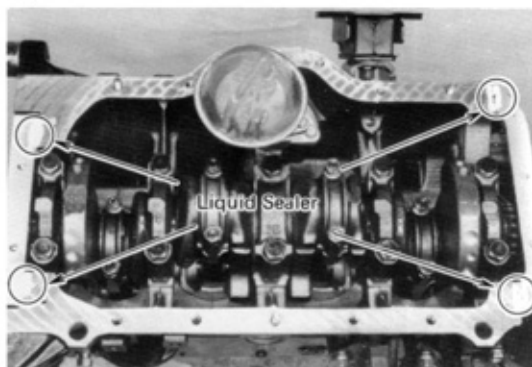
Be careful not to fall the No. 2 chain into the cover.

Fig. 4-97



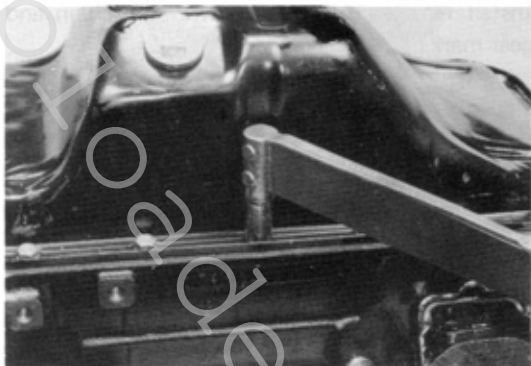
In installing the upper right bolt for mounting the chain cover, insert seal washer and apply liquid sealer on the threads.

Fig. 4-98



Apply liquid sealer as shown.

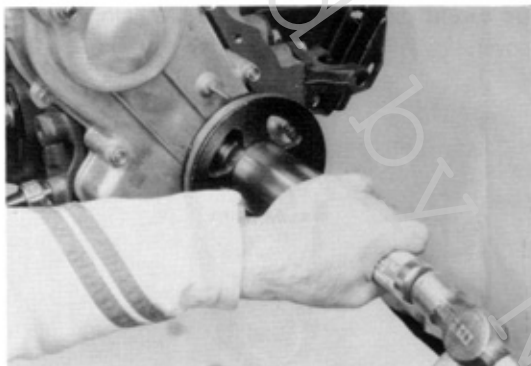
Fig. 4-99



Install oil pan.

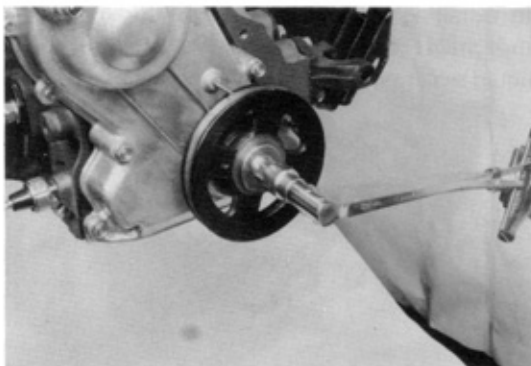
Torque**0.4–0.8 kg-m (2.9–5.8 ft-lb)**

Fig. 4-100



Drive in crankshaft pulley with use SST [09214-60010].

Fig. 4-101



Tighten claw nut.

Torque**9.0–11.0 kg-m (65.1–79.6 ft-lb)**

UpLoaded by NOOB Auto Parts

CYLINDER BLOCK DISASSEMBLY

Disassemble in numerical order

Fig. 4-110

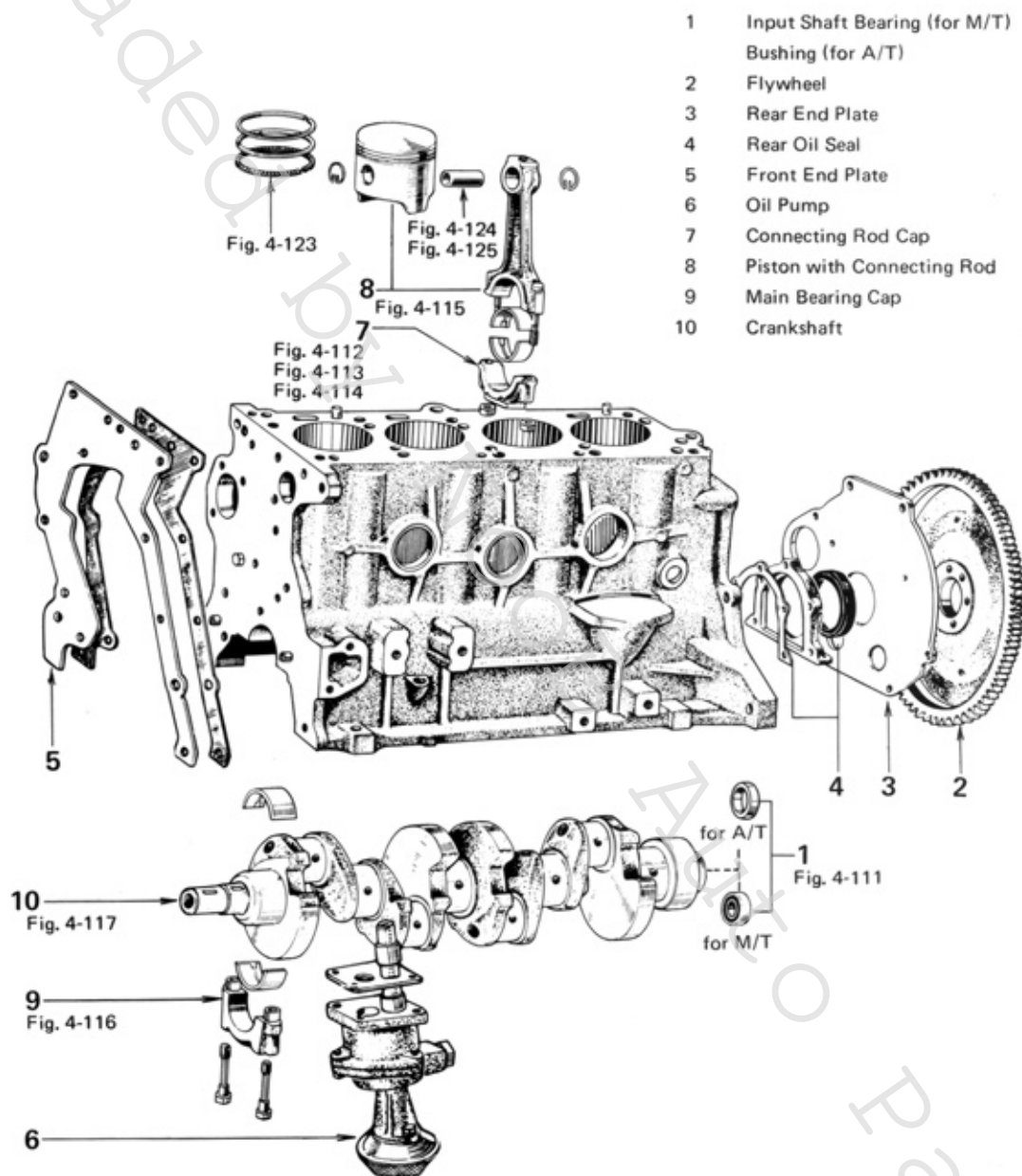
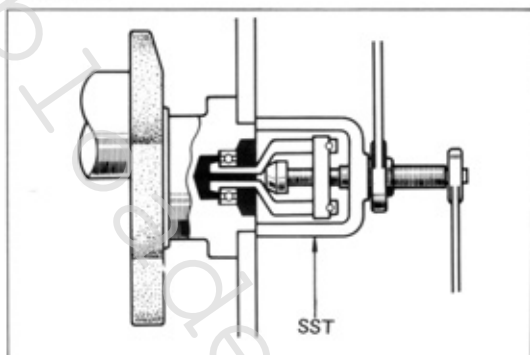


Fig. 4-111



Using SST [09303-35010], remove input shaft bearing.

Fig. 4-112



Measure connecting rod thrust clearance. If it exceeds limit, replace connecting rod.

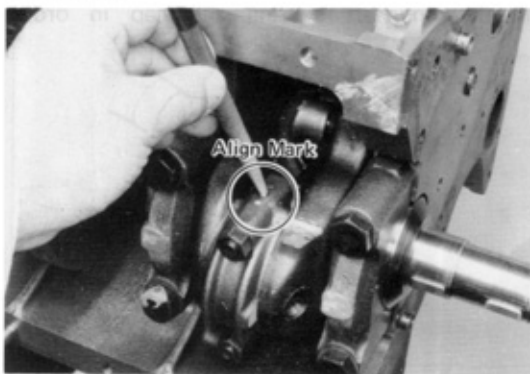
Thrust clearance limit

0.3 mm (0.012 in)

Standard

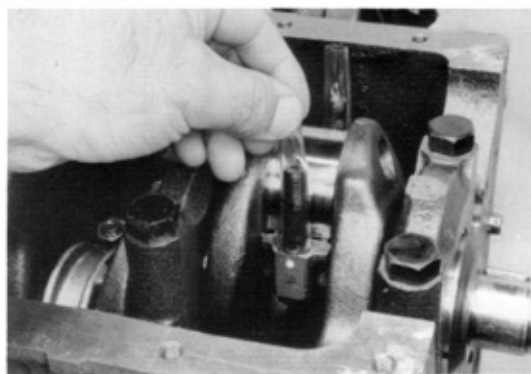
0.16–0.26 mm (0.0063–0.010 in)

Fig. 4-113



Mark connecting rod and cap for correct reassembly.

Fig. 4-114



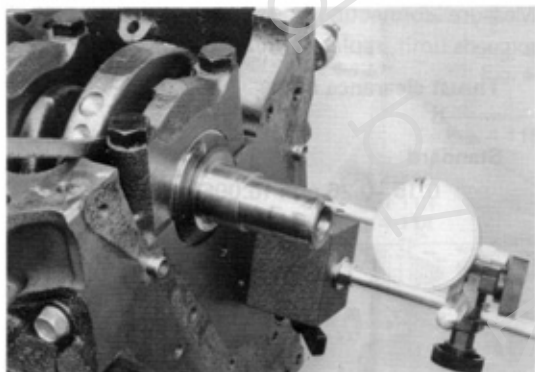
Cover rod bolts with a short length of hose to protect crankshaft from damage.

Fig. 4-115



Keep connecting rod and bearing in order.

Fig. 4-116



Measure crankshaft thrust clearance. If it exceeds limit, replace bearing as a set.

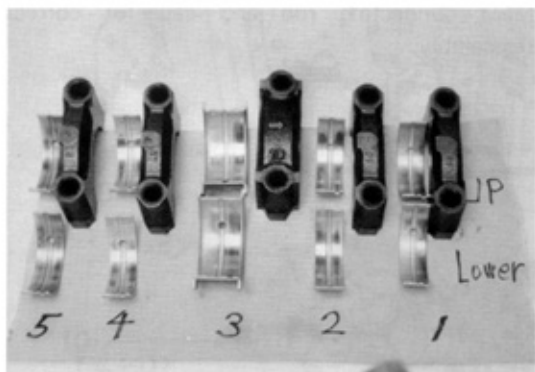
Thrust clearance limit

0.3 mm (0.012 in)

Standard

0.06–0.20 mm (0.0024–0.0079 in)

Fig. 4-117



Keep crankshaft bearing and cap in order.

Fig. 4-118

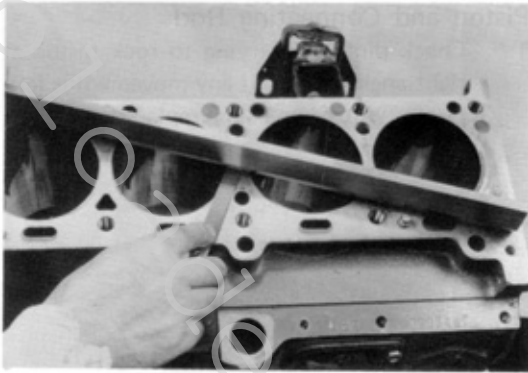


Fig. 4-119

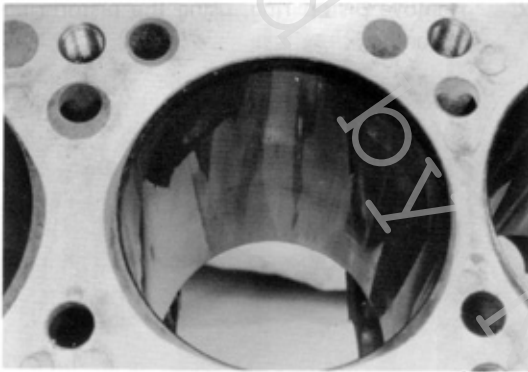


Fig. 4-120

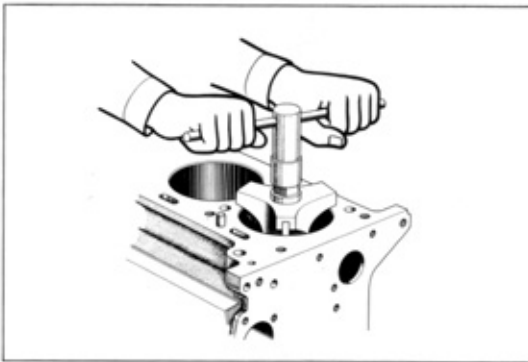
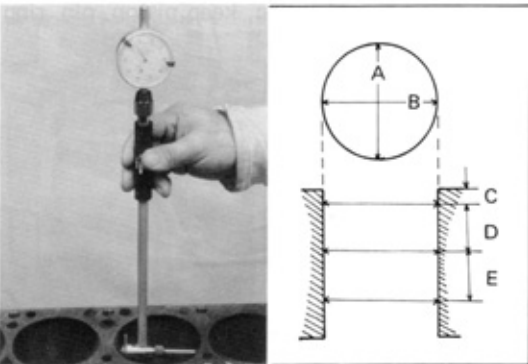


Fig. 4-121

**INSPECTION & REPAIR****Cylinder Block**

1. Check block gasket surface for flatness. If warpage exceeds limit, correct by machining or replace block.

Warpage limit 0.05 mm (0.0019 in)



2. Visually inspect cylinders for vertical scratches. If deep scratches are present, cylinder must be rebored.

3. Machine piston ring ridge from top of cylinder.

— Note —

If this step is not performed prior to removing pistons, piston ring lands will be damaged.



4. Measure cylinder bore at position as shown.

A : Thrust Direction

B : Axial Direction

C : 15 mm (0.59 in)

D : 60 mm (2.36 in)

E : 60 mm (2.36 in)

If bore exceeds specification, it must be rebored.

Wear limit 0.2 mm (0.008 in)

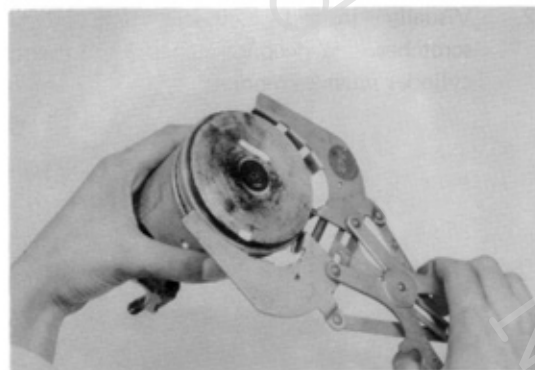
**Standard 88.50–88.55 mm
(3.4842–3.4862 in)**

Fig. 4-122

**Piston and Connecting Rod**

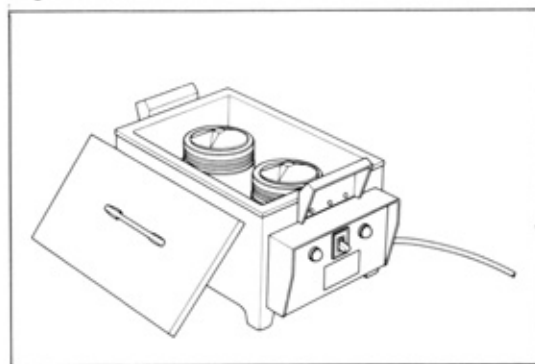
1. Check pin fit by trying to rock piston at right angle to pin. If any movement is felt, piston with pin must be replaced.

Fig. 4-123



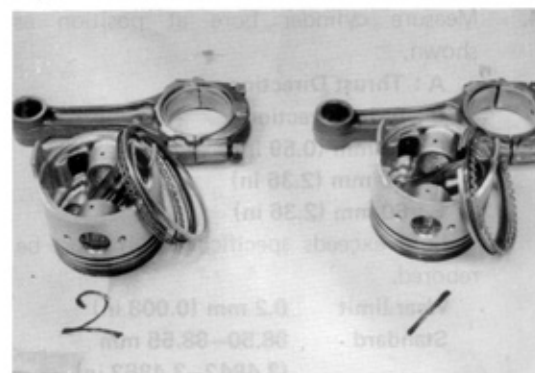
2. Remove piston ring, using the piston ring expander.

Fig. 4-124



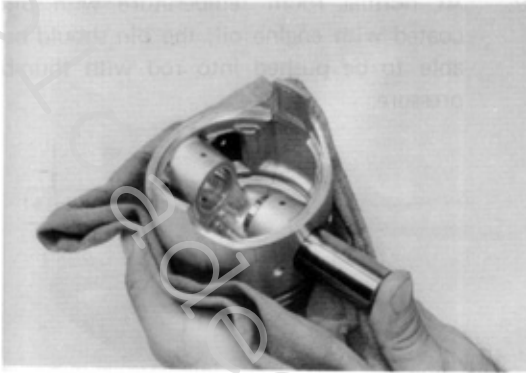
3. Heat piston in piston heater to about 100°C (212°F) and remove piston pin.

Fig. 4-125



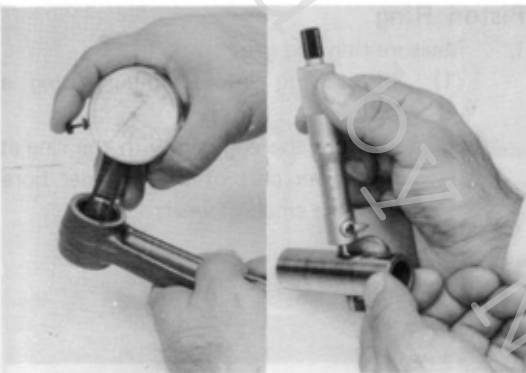
4. After disassembling, keep piston, pin, ring and rod in order.

Fig. 4-126



5. Heat piston to 100°C (212°F) coat pin with engine oil.
The pin should be able to be pushed into piston hole with thumb pressure.

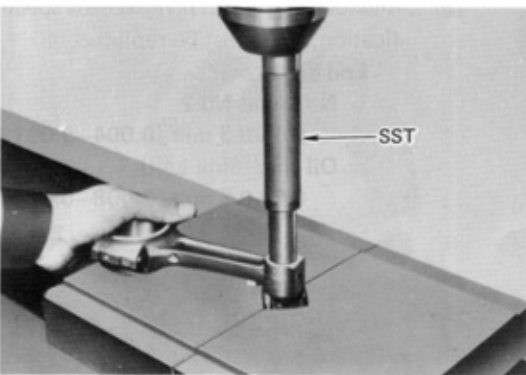
Fig. 4-127



6. Measure oil clearance between bush and pin.

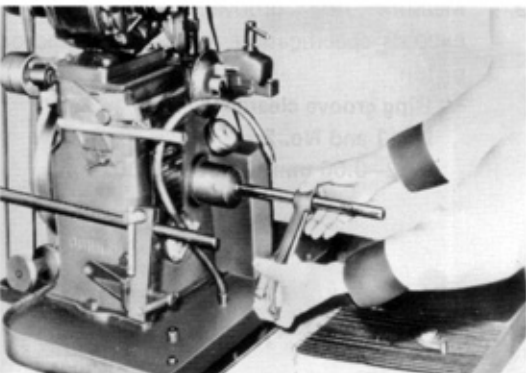
Oil Clearance limit
0.02 mm (0.0008 in)

Fig. 4-128



7. Replace bushing with SST [09222-30010].

Fig. 4-129



8. After pressing in the bushing, finish the bushing bore with a pin hole grinder.

Fig. 4-130

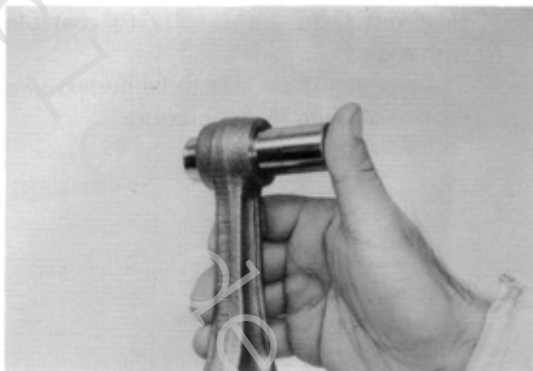


Fig. 4-131

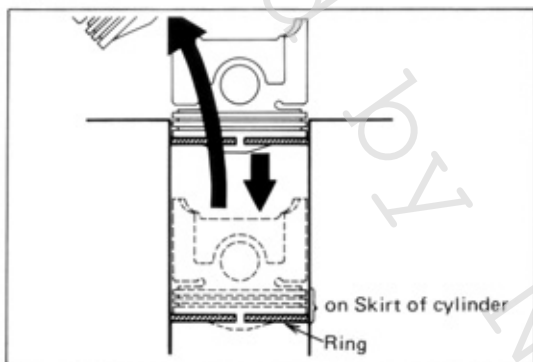


Fig. 4-132

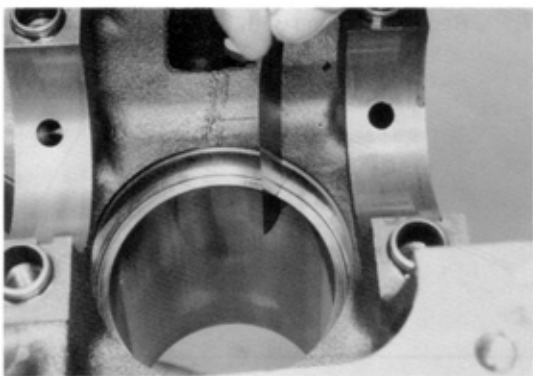


Fig. 4-133



9. At normal room temperature with pin coated with engine oil, the pin should be able to be pushed into rod with thumb pressure.



Piston Ring

1. Measure ring end gap.
 - (1) Insert ring into cylinder using a piston.
Measure the end gap with the ring at the lower part of the cylinder bore with the smallest wear.



- (2) Measure end gap. If it exceeds specification, ring must be replaced.

End gap:

No.1 and No.2

0.1–0.3 mm (0.004–0.0012 in)

Oil ring (Side Lail)

0.2–0.5 mm (0.008–0.020 in)



2. Measure ring groove clearance. If it exceeds specification, replace ring and/or piston.

Ring groove clearance

No. 1 and No. 2

0.02–0.06 mm (0.0008–0.0024 in)

Fig. 4-134

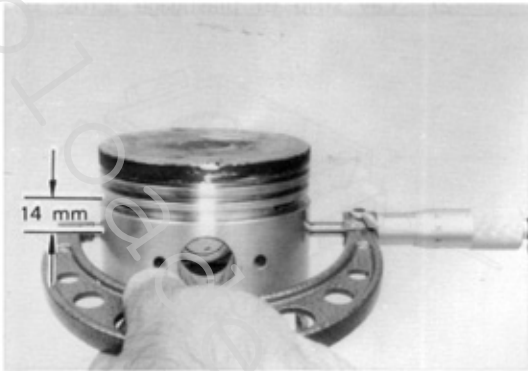


Fig. 4-135

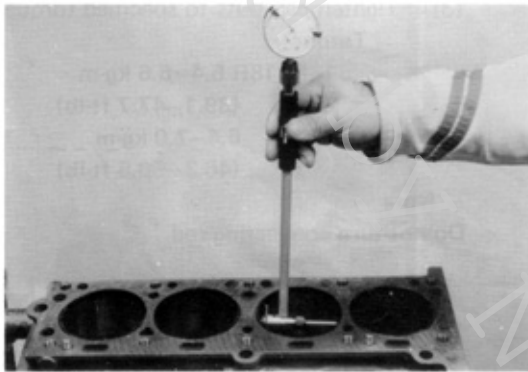


Fig. 4-136

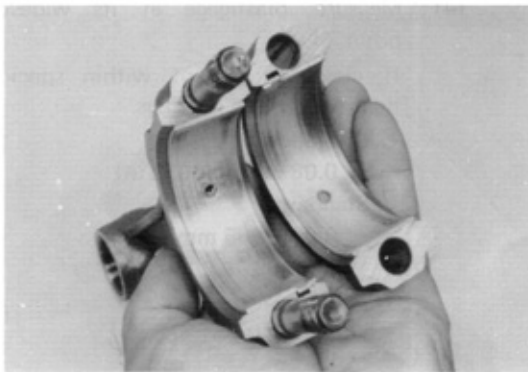
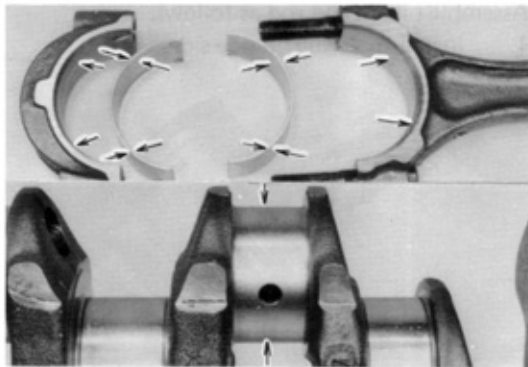


Fig. 4-137

**Piston Clearance**

1. Measure piston diameter at right angle to piston pin center line. Measurement must be made at normal temperature (20°C or 68°F).

Piston diameter (STD)

88.44–88.49 mm

(3.4819–3.4839 in)



2. Measure cylinder bore and subtract piston measurement. If clearance exceeds specification, replace piston.

Piston clearance

0.05–0.07 mm (0.0020–0.0028 in)

**Crankpin and Bearing**

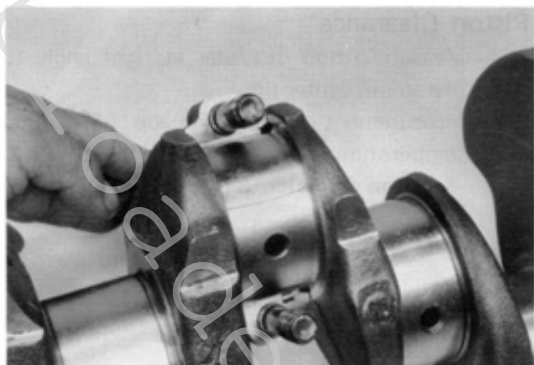
1. Inspect bearings for flaking or scoring. If bearings are damaged, replace.



2. Measure crankpin oil clearance.

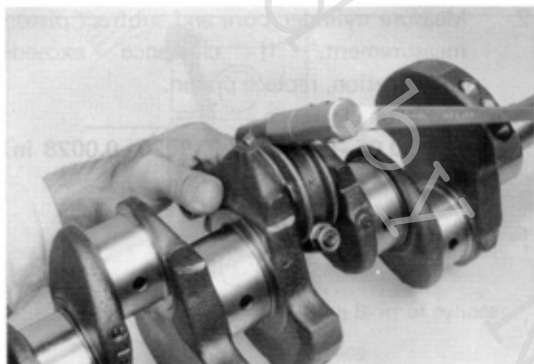
(1) Clean crankshaft pin, rod, cap and bearing.

Fig. 4-138



- (2) Lay strip of plastigage across pin.

Fig. 4-139



- (3) Tighten cap nuts to specified torque.

Torque

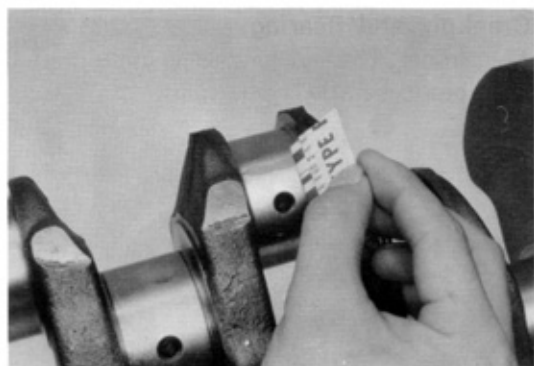
16R, 18R 5.4–6.6 kg-m
(39.1–47.7 ft-lb)

18R-G 6.4–7.0 kg-m
(46.3–50.6 ft-lb)

— Note —

Do not turn connecting rod.

Fig. 4-140



- (4) Measure plastigage at its widest point.

If clearance is not within specification, replace bearings.

Clearance limit

0.08 mm (0.0032 in)

Standard

0.02–0.05 mm
(0.0008–0.0020 in)

U/S Bearing sizes

U/S 0.05, 0.25, 0.50

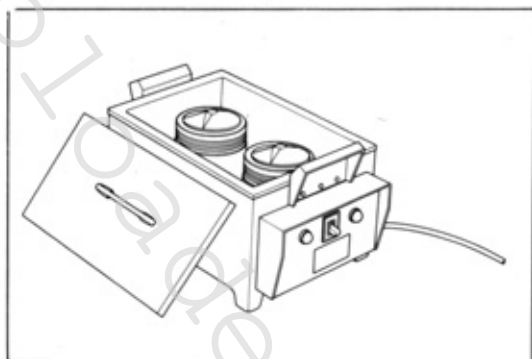
Fig. 4-141



Assemble piston and rod as follows.

1. Install snap ring on one side.

Fig. 4-142



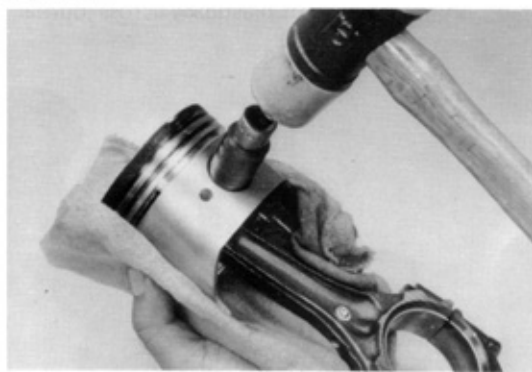
2. Heat piston to about 100° (212°F).

Fig. 4-143



3. Aligning piston notch and rod mark as shown.

Fig. 4-144



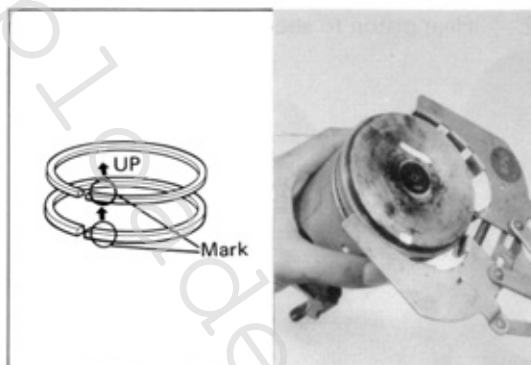
4. Install piston pin.

Fig. 4-145



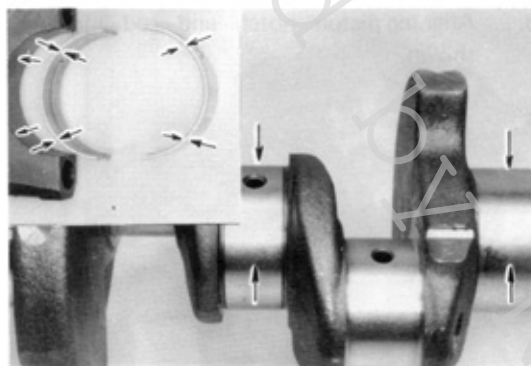
5. Install snap ring on other side. Make sure snap ring is completely in place.

Fig. 4-146



6. Install piston ring, using piston ring expander.
Install two compression rings with code marks facing up.

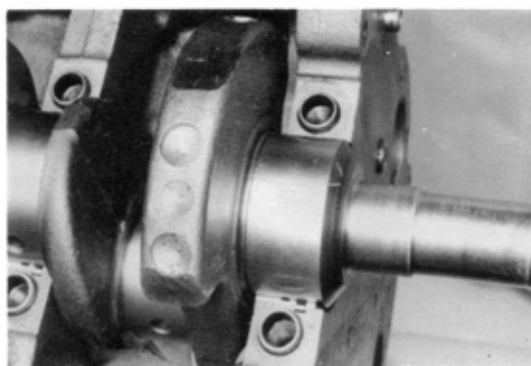
Fig. 4-147



Crankshaft and Bearing

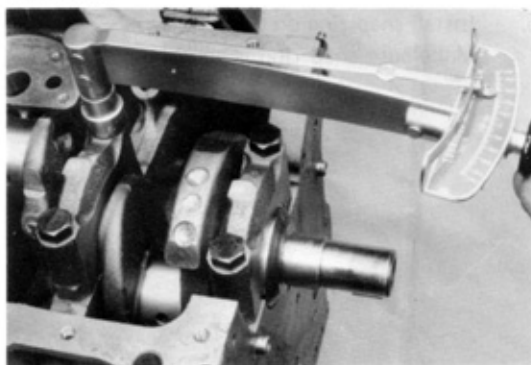
1. Measure crankshaft oil clearance.
 - (1) Clean journal, cap and bearing

Fig. 4-148



- (2) Lay strip of plastigage across journal.

Fig. 4-149



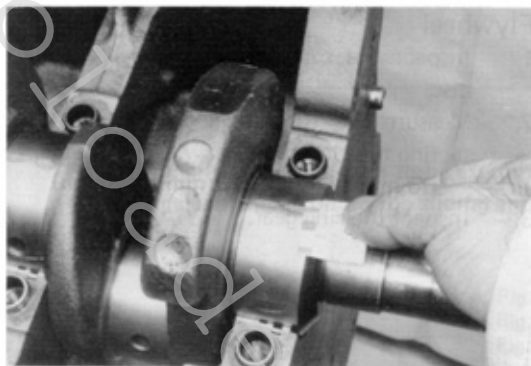
- (3) Tighten cap nuts to specified torque.

| | |
|---------------|-------------------|
| Torque | 16R, 18R |
| | 9.5–11.5 kg-m |
| | (68.7–83.2 ft-lb) |
| 18R-G | 10.0–11.0 kg-m |
| | (72.3–79.6 ft-lb) |

— Note —

Do not turn crankshaft.

Fig. 4-150



- (4) Measure plastigage at its widest point. If clearance is not within specification, replace bearing.

Clearance limit

0.08 mm (0.0032 in)

Standard

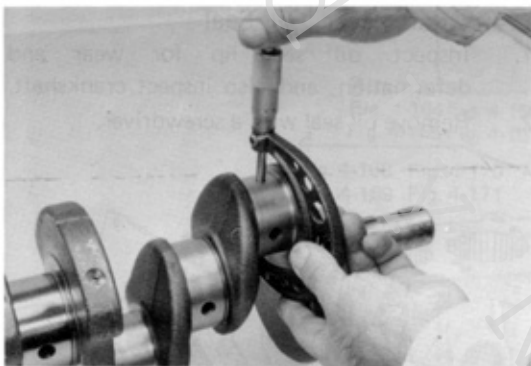
0.02–0.05 mm

(0.0008–0.0020 in)

U/S bearing sizes

U/S 0.05, 0.25, 0.50

Fig. 4-151

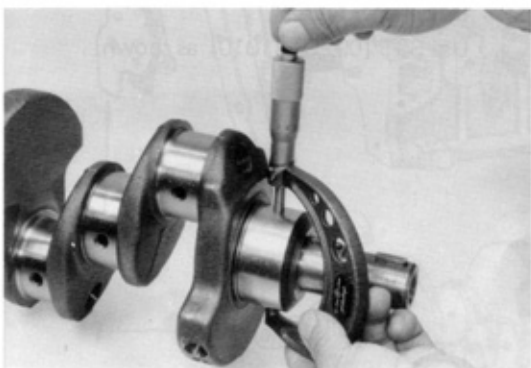


2. Measure crankpin journal. If wear is excessive, crankshaft must be reground or replaced.

Crankpin Journal Size

| | |
|----------|--|
| STD | 52.976–53.000 mm (2.0857–2.0867 in) |
| U/S 0.25 | 52.70–52.71 mm (2.0748–2.0752 in) |
| U/S 0.50 | 52.45–52.46 mm (2.0650–2.0654 in) |

Fig. 4-152

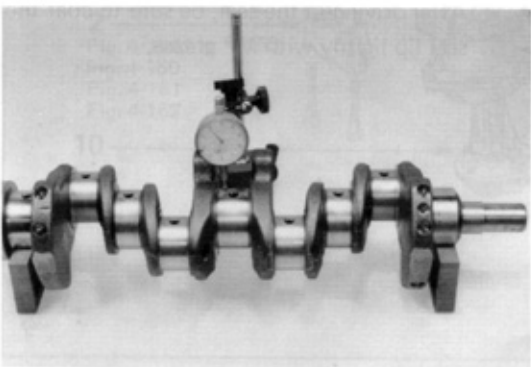


3. Measure crankshaft main journal. If wear is excessive, crankshaft must be reground or replace.

Crankshaft Main Journal Size

| | |
|----------|--|
| STD | 59.976–60.000 mm (2.3613–2.3622 in) |
| U/S 0.25 | 59.70–59.71 mm (2.3504–2.3508 in) |
| U/S 0.50 | 59.45–59.46 mm (2.3406–2.3409 in) |

Fig. 4-153



4. Check crankshaft for runout and if it exceeds limit, replace.

Run out limit 0.05 mm (0.0020 in)

Fig. 4-154

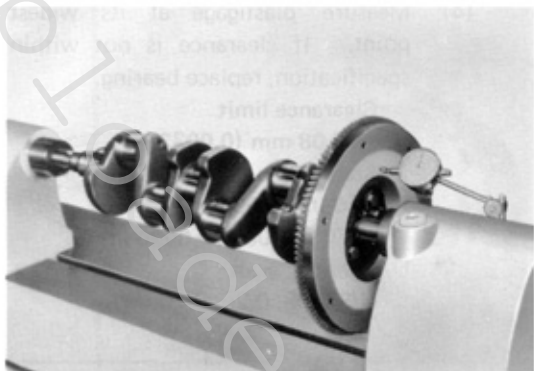


Fig. 4-155



Fig. 4-156

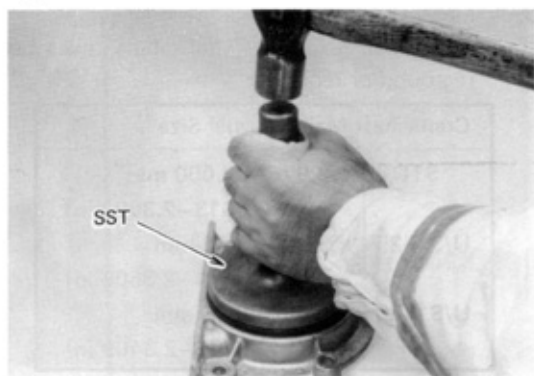
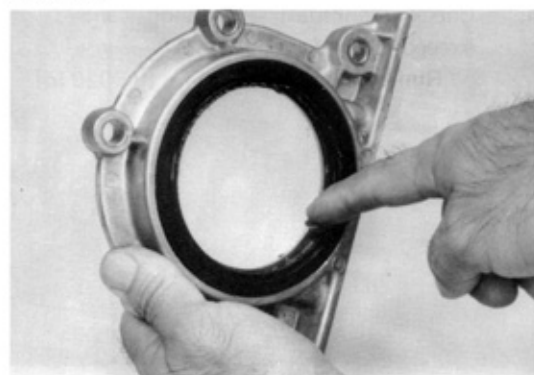


Fig. 4-157

**Flywheel**

1. Inspect the surface contacting the clutch disc.
2. Measure the runout of the surface contacting the clutch disc.

Runout limit 0.2 mm (0.008 in)

3. Inspect the ring gear.

**Crankshaft Rear Oil Seal**

1. Inspect oil seal lip for wear and deformation, and also inspect crankshaft.
2. Remove oil seal with a screwdriver.



3. Install new oil seal.
Use SST [09223-41010] as shown.



4. After driving in the seal, be sure to coat the seal lip lightly with MP grease.

ASSEMBLY

Assemble in numerical order

Fig. 4-158

- Thoroughly clean the parts to be assembled.
- Apply clean engine oil on the sliding and rotating surfaces of the parts before assembly.

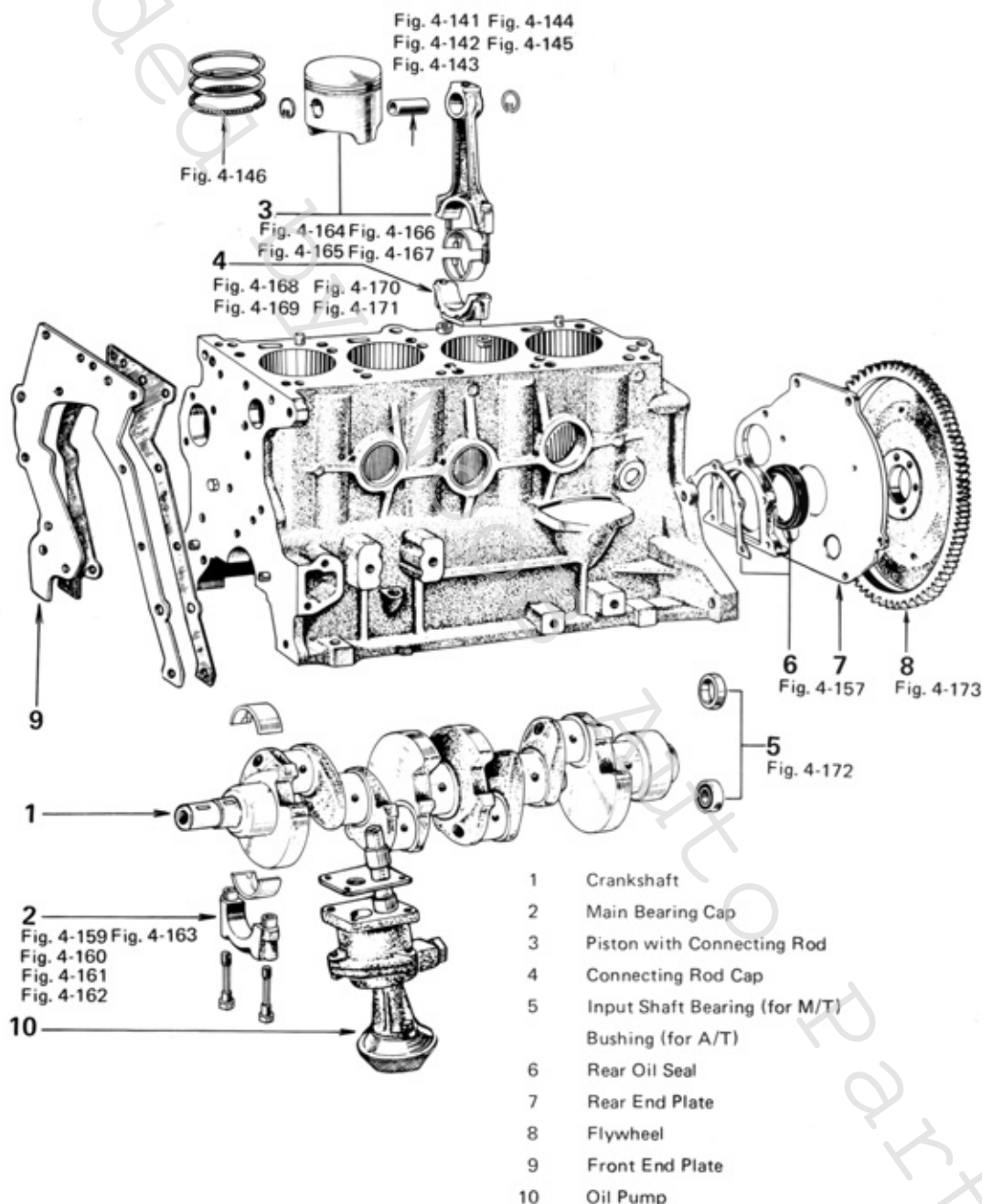
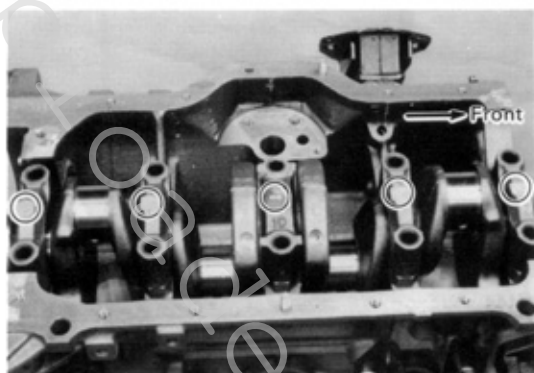
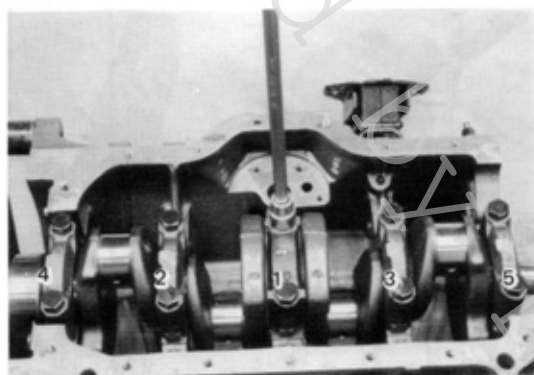


Fig. 4-159



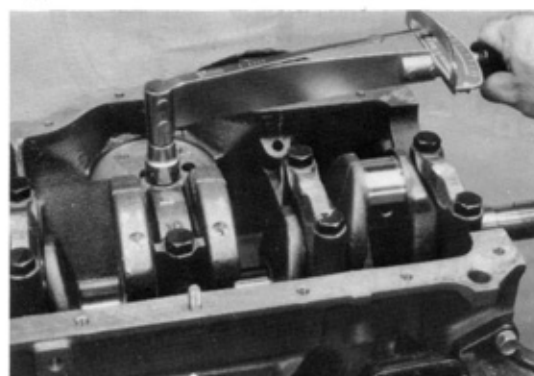
Face the arrow mark toward front.

Fig. 4-160



Gradually tighten bearing cap bolts in 2 to 3 stages as shown.

Fig. 4-161

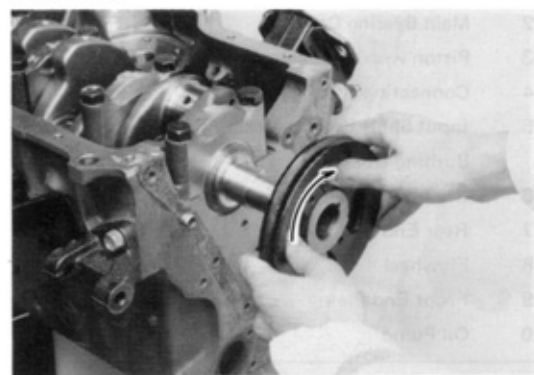


Tighten bearing caps to specified torque.

Torque

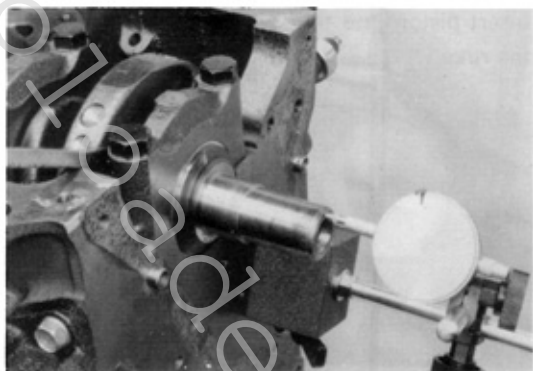
| | |
|-----------------|---|
| 16R, 18R | 9.5–11.5 kg-m (68.7–83.2 ft-lb) |
| 18R-G | 10.0–11.0 kg-m (72.3–79.6 ft-lb) |

Fig. 4-162



Make sure crankshaft rotates smoothly.

Fig. 4-163

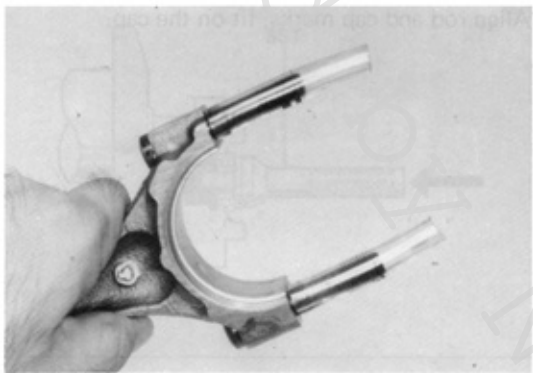


Make sure crankshaft thrust clearance.

Thrust clearance

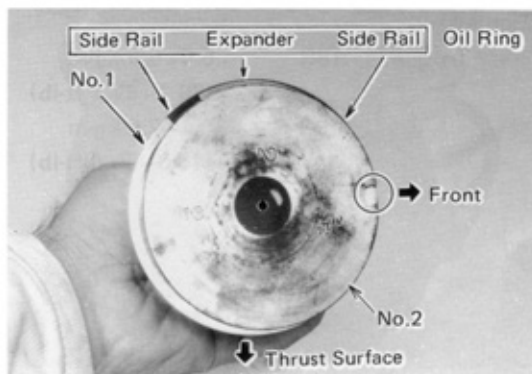
| | |
|-----------------|---|
| Limit | 0.3 mm (0.0118 in) |
| Standard | 0.002–0.20 mm (0.0008–0.0079 in) |

Fig. 4-164



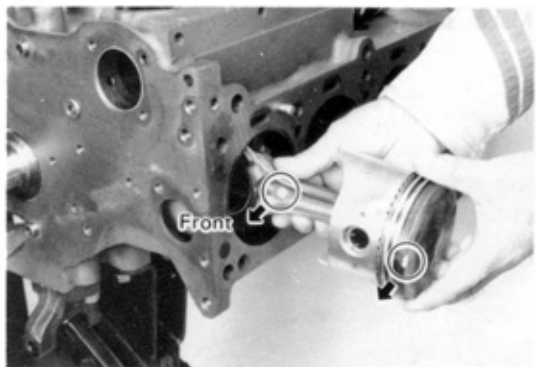
Cover rod bolts with a hose to protect crankpin from damage.

Fig. 4-165



Position ring gap in direction as shown.

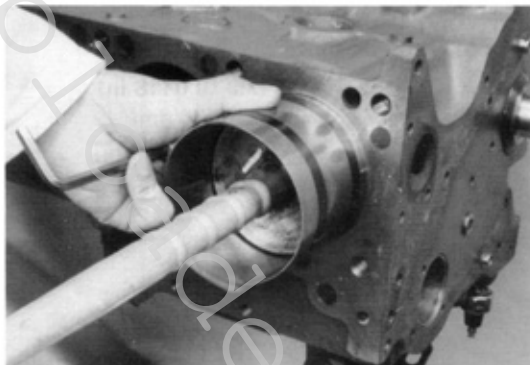
Fig. 4-166



Push correctly numbered piston/rod assembly with notch forward.

Mark on connecting rod should face forward.

Fig. 4-167



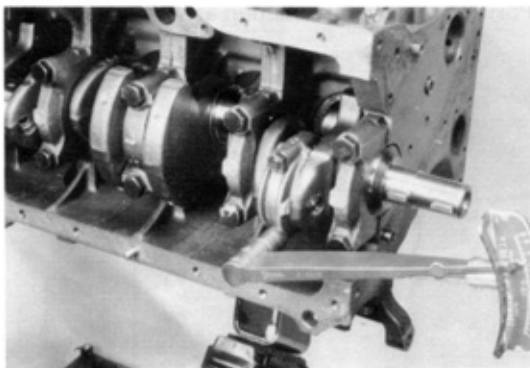
Insert piston into the cylinder while compressing the rings with a piston ring compressor.

Fig. 4-168



Align rod and cap marks, fit on the cap.

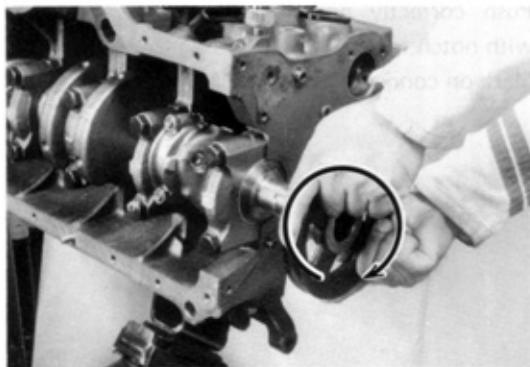
Fig. 4-169



Tighten rod cap to specified torque.

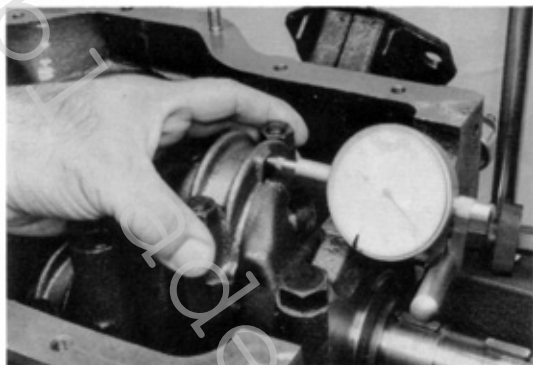
| Torque | 18R | 5.4–6.6 kg-m (39.1–47.7 ft-lb) |
|--------|-------|-----------------------------------|
| | 18R-G | 6.4–7.0 kg-m (46.3–50.6 ft-lb) |

Fig. 4-170



Make sure the crankshaft rotates smoothly.

Fig. 4-171



Check connecting rod thrust clearance.

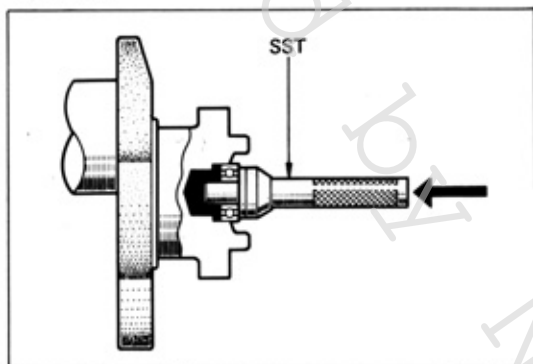
Thrust clearance limit

0.3 mm (0.012 in)

Standard 0.16–0.26 mm

(0.0063–0.0102 in)

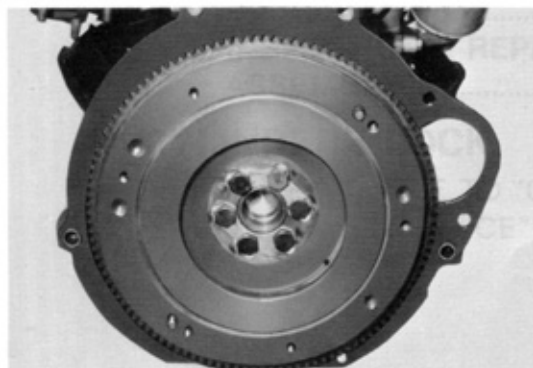
Fig. 4-172



Drive in input shaft bearing.

Use SST [09304-30012].

Fig. 4-173



Tighten flywheel to specified torque.

| Torque | 18R | 7.0–8.0 kg-m (50.6–57.9 ft-lb) |
|--------|-------|-----------------------------------|
| | 18R-G | 8.2–8.8 kg-m (59.3–63.7 ft-lb) |

UpLoaded by Noob Auto Parts

18R-G ENGINE SERVICE

| | Page |
|---|-------------|
| CUTAWAY VIEW | 5-1 |
| CYLINDER HEAD | |
| Includes: Cylinder Head, Valve and Spring Valve Lifter, Camshaft, Manifold Valve Clearance Adjustment | |
| DISASSEMBLY | 5-4 |
| INSPECTION & REPAIR | 5-10 |
| ASSEMBLY | 5-18 |

TIMING CHAIN

Includes: Timing Gear and Chain
Chain Tensioner, Damper and Slipper
Pump Drive Shaft and Bearing, Front Oil Seal

| | |
|--------------------------------------|-------------|
| DISASSEMBLY | 5-34 |
| INSPECTION & REPAIR | 5-36 |
| ASSEMBLY | 5-41 |

CYLINDER BLOCK

SEE TO "CYLINDER BLOCK OF 16R • 18R ENGINE
SERVICE" SECTION

CUTAWAY VIEW

Fig. 5-1

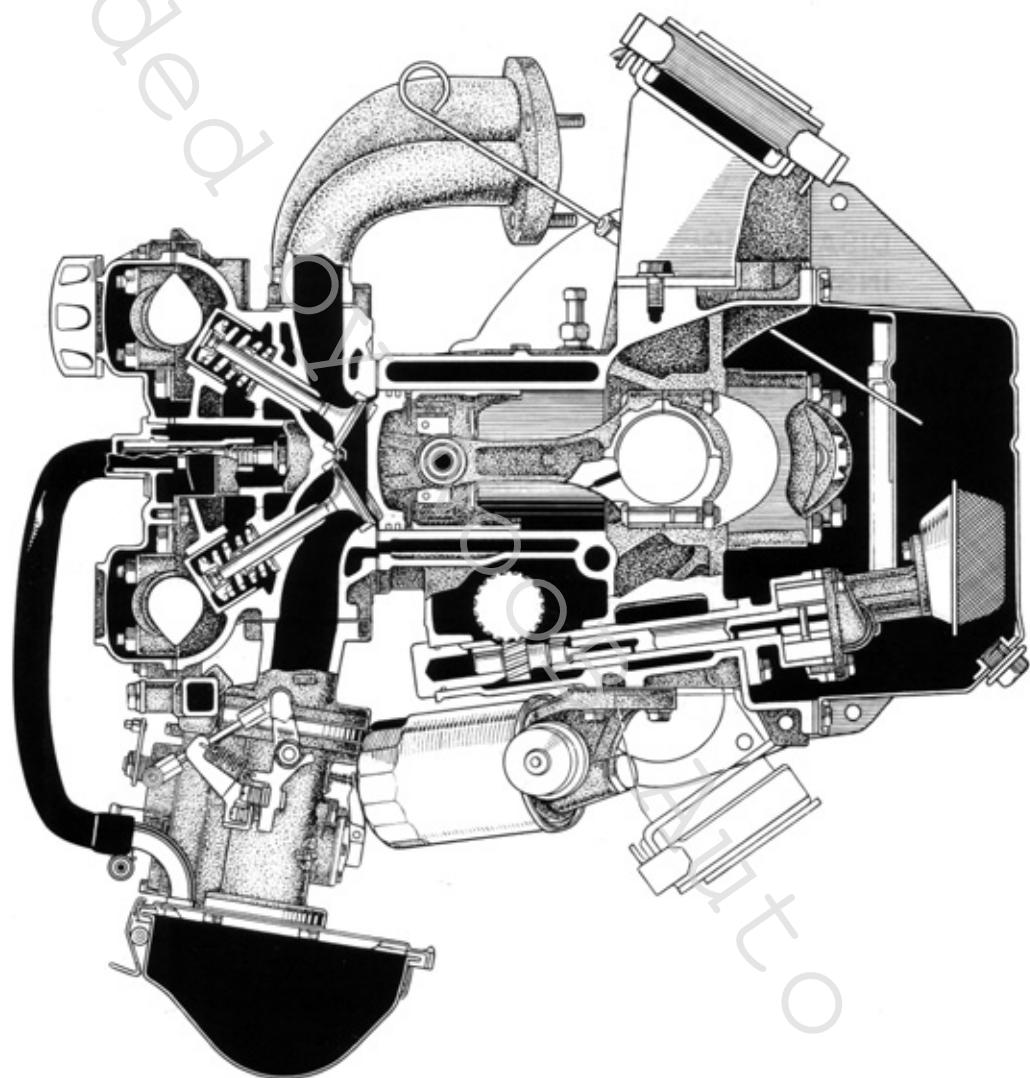
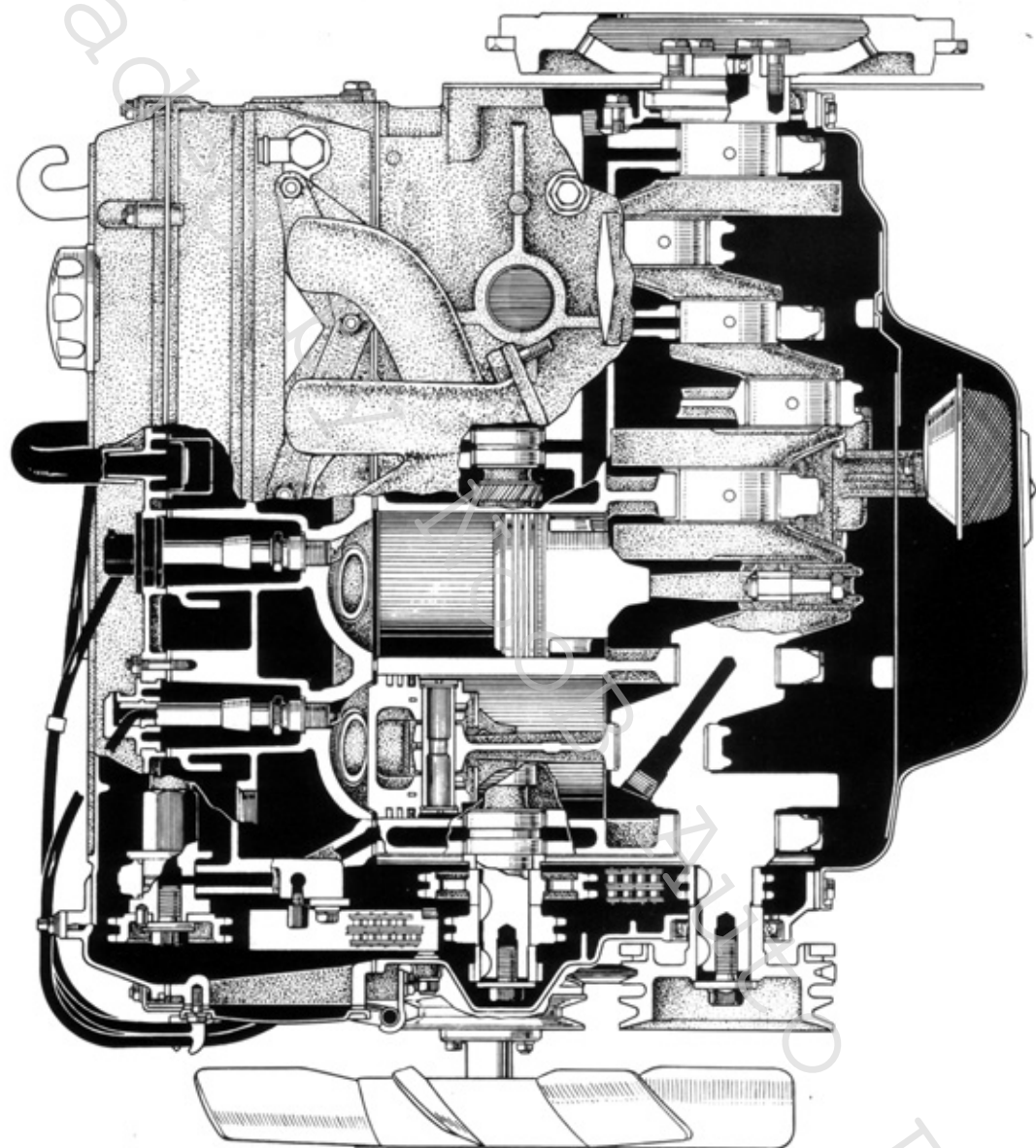


Fig. 5-2



CYLINDER HEAD DISASSEMBLY

Disassemble in numerical order.

Fig. 5-3

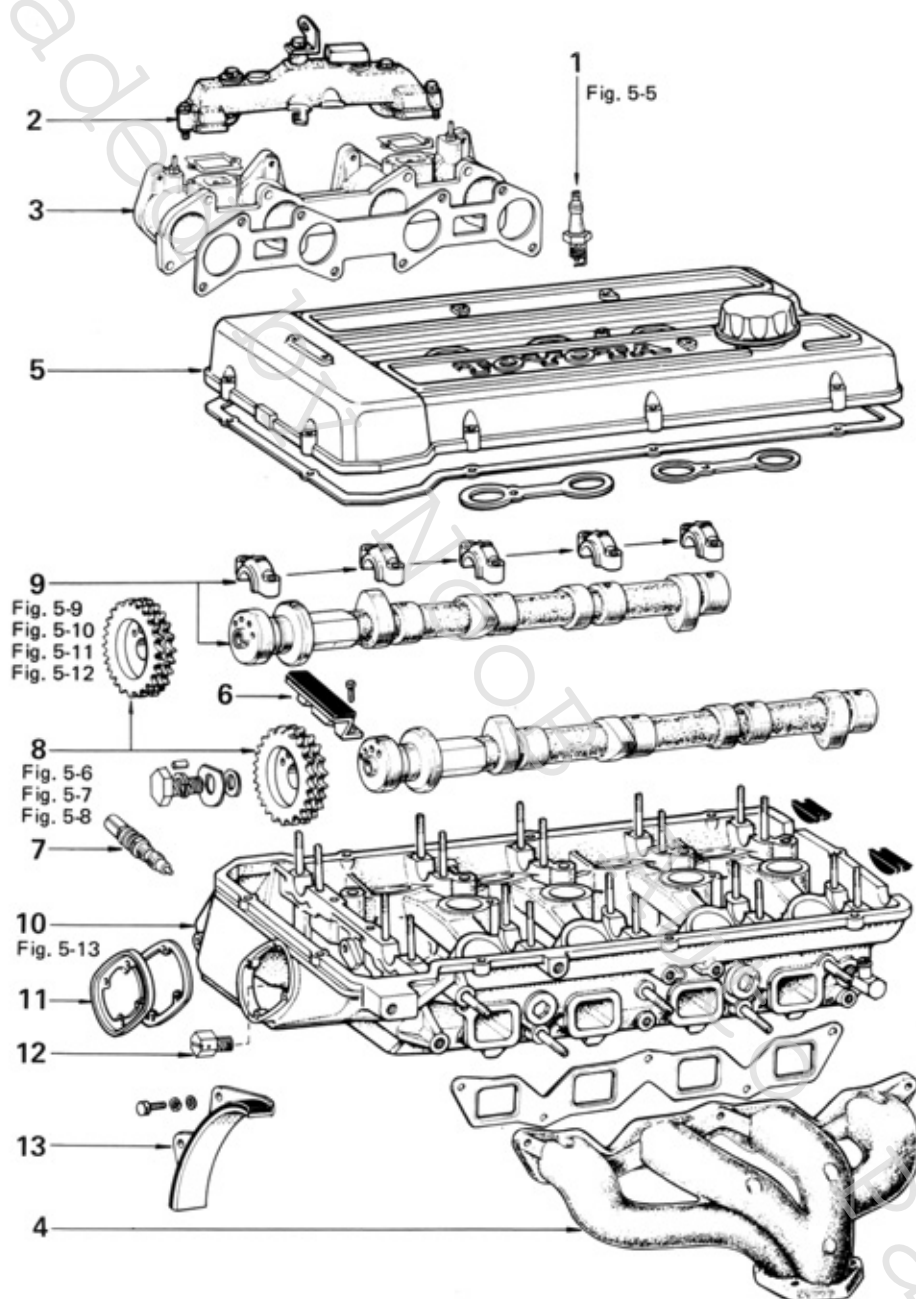
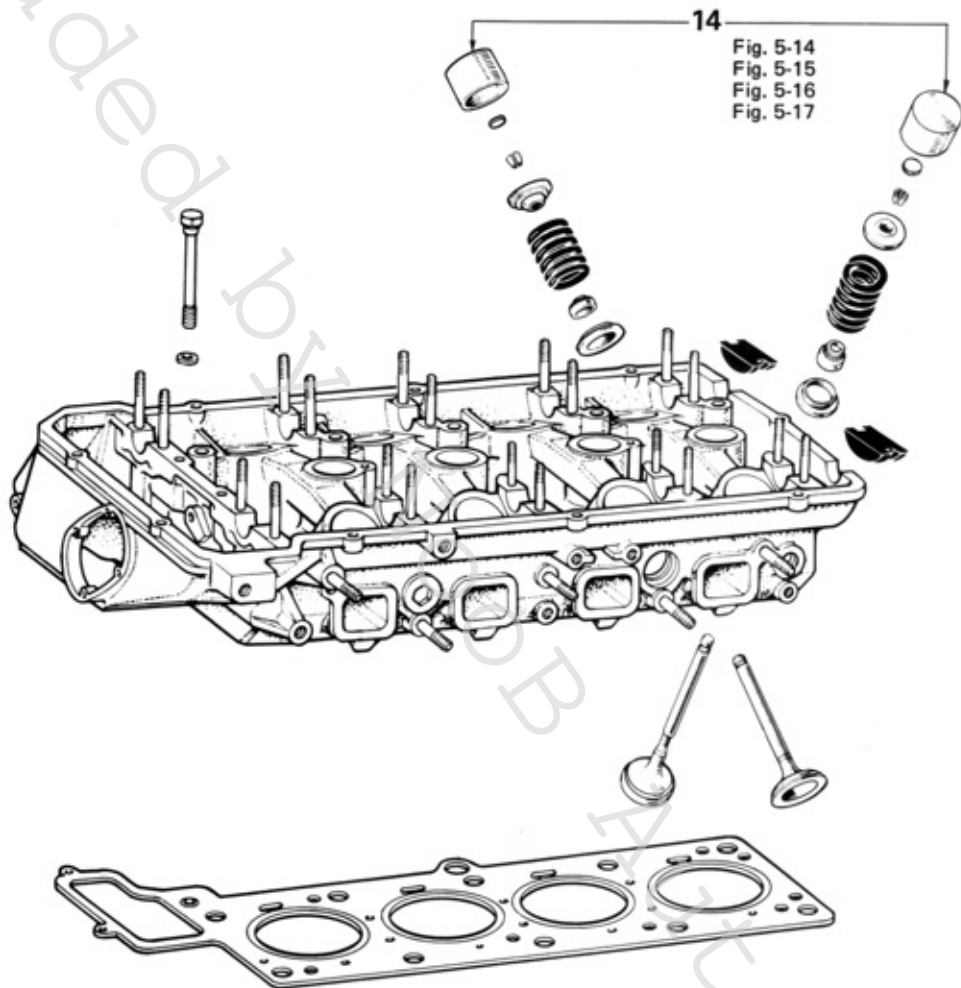


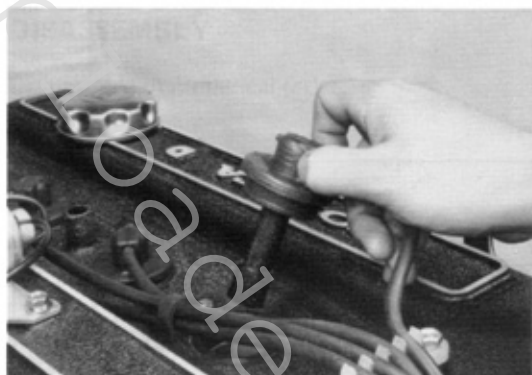
Fig. 5-4



- 1 Spark Plug
- 2 Balance Tube
- 3 Carburetor and Intake Manifold
- 4 Exhaust Manifold
- 5 Cylinder Head Cover
- 6 No.2 Vibration Damper
- 7 No.2 Chain Tensioner

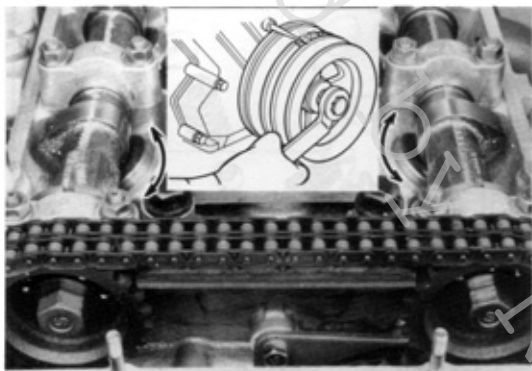
- 8 Camshaft Timing Gear
- 9 Camshaft and Bearing Cap
- 10 Cylinder Head
- 11 Front Cover
- 12 Oil Nozzle
- 13 No.3 Vibration Damper
- 14 Valve and Spring

Fig. 5-5



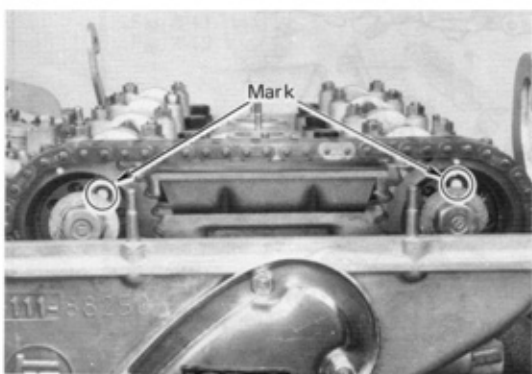
Remove carefully plug cords by pulling rubber boot.

Fig. 5-6



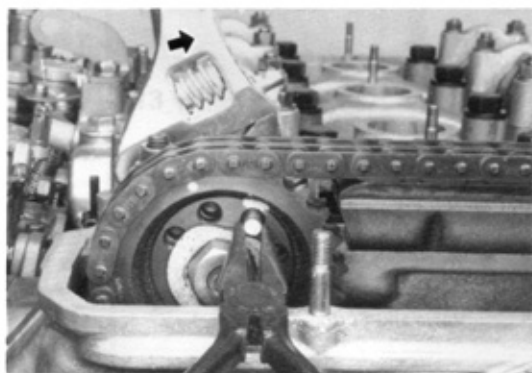
Set No.1 cylinder TDC/compression.
At this time, intake and exhaust valve lifters on No.1 cylinder should be rotate.

Fig. 5-7



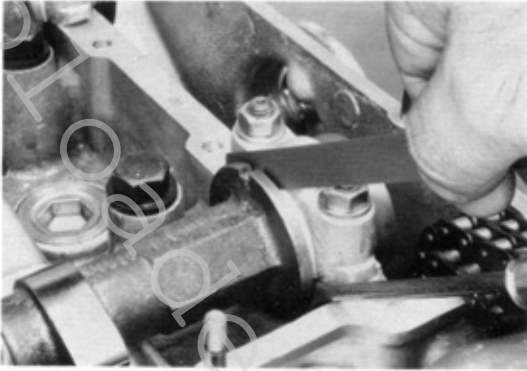
Place aligning marks between the gears and the pin holes for correct reassembly.

Fig. 5-8



It will be easier to pull out the pin if the camshaft is turned slightly in normal direction so as to provide play.

Fig. 5-9

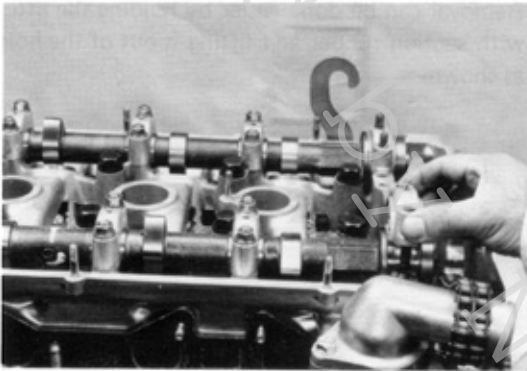


Measure camshaft thrust clearance.

Thrust clearance

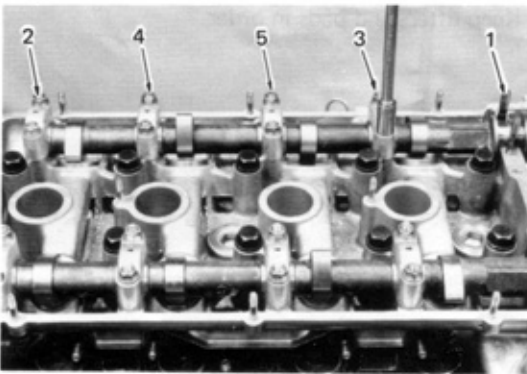
limit 0.4 mm (0.0158 in)

Fig. 5-10



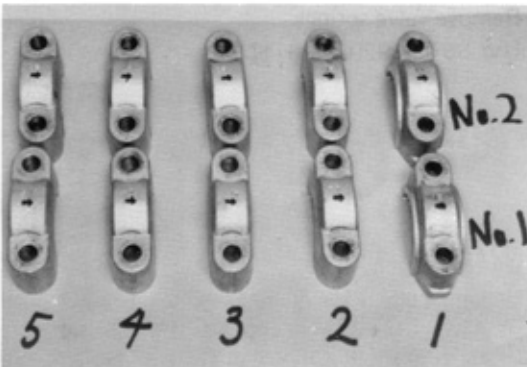
Remove No.1 bearing cap.

Fig. 5-11



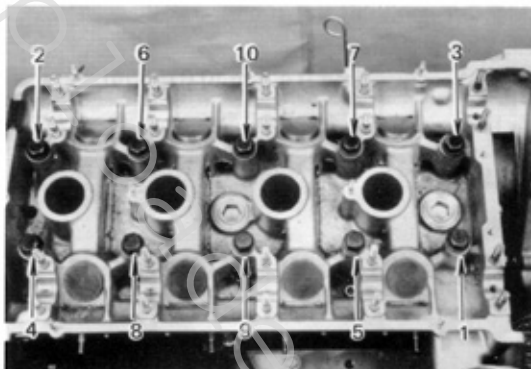
Gradually loosen the other cap nuts in 2 to 3 stages in the sequence as shown.

Fig. 5-12



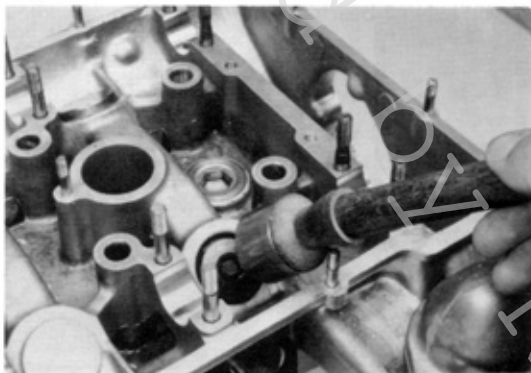
Keep bearing caps in order.

Fig. 5-13



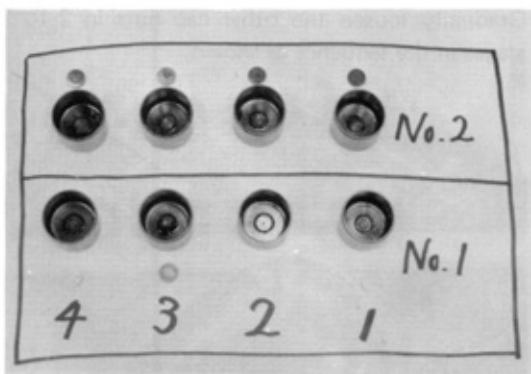
Gradually loosen cylinder head bolts in 2 to 3 stages in the sequence as shown.

Fig. 5-14



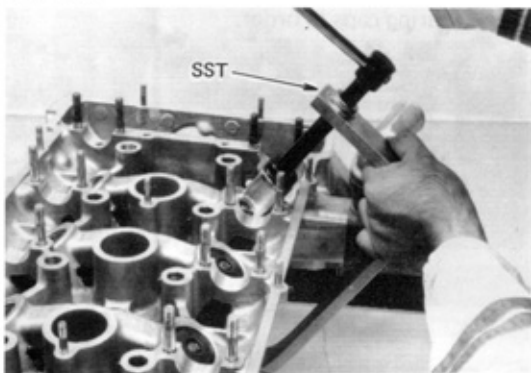
Removal can be done easier by holding the lifter with suction rubber and lifting it out of the hole as shown.

Fig. 5-15



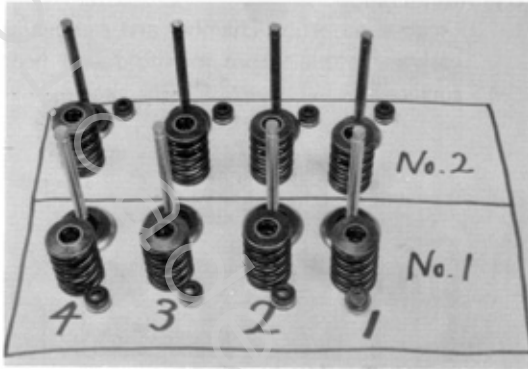
Keep lifters and pads in order.

Fig. 5-16



Remove valve springs.
Use SST [09202-43011]

Fig. 5-17



Keep valves, springs and oil seal in order.

Fig. 5-20

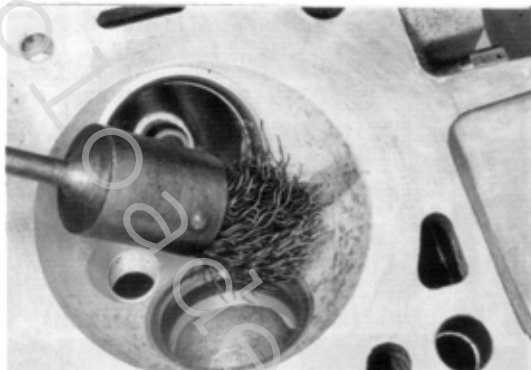


Fig. 5-21

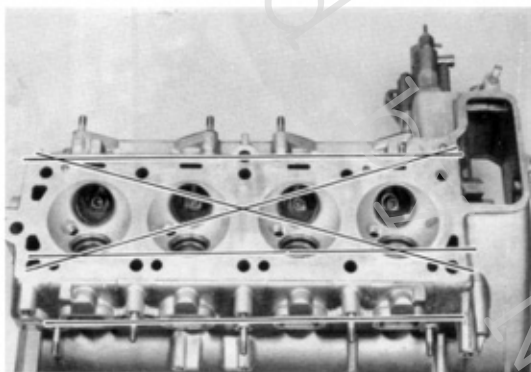


Fig. 5-22

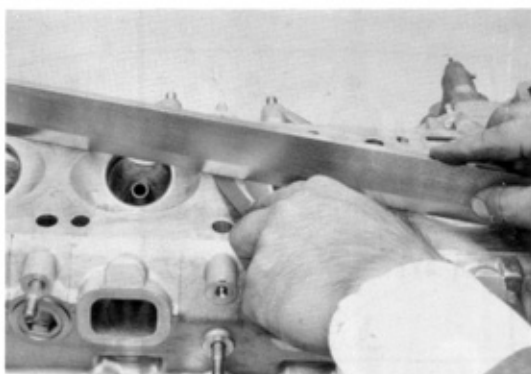
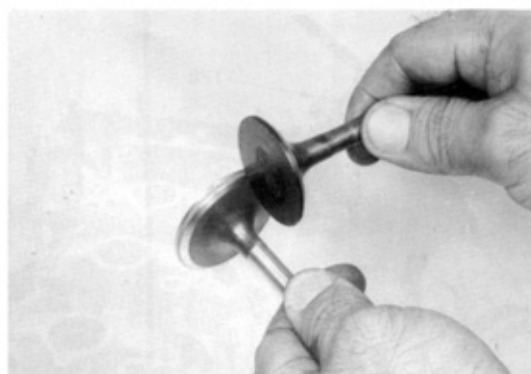


Fig. 5-23



INSPECTION & REPAIR

Cylinder Head



1. Clean combustion chamber and remove all gasket material from manifold and head surface.



2. Using a precision straight edge, check head surface for flatness.



3. If warpage exceeds limit, correct by machining or replace head.

Head surface warpage limit

0.05 mm (0.0019 in)

Maximum reface limit

0.2 mm (0.0079 in)

Manifold mounting surface warpage

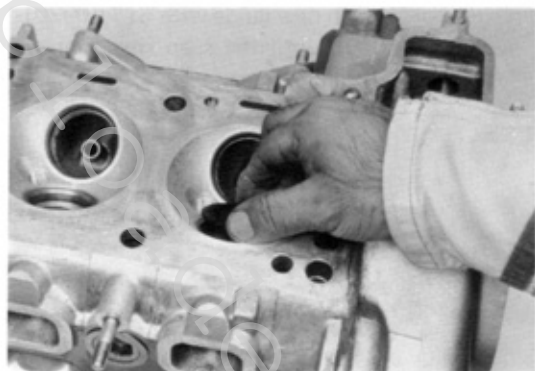
limit 0.10 mm (0.004 in)



Valve, Guide and Seat

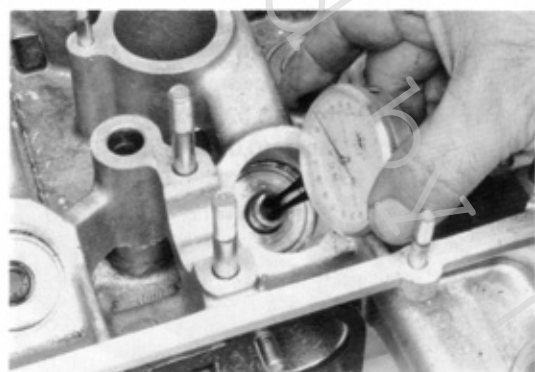
1. Clean valves.

Fig. 5-24



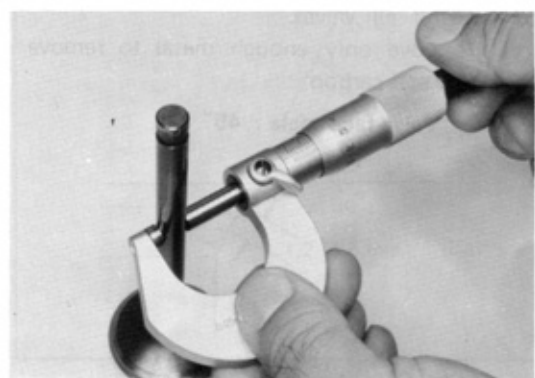
2. Quick-check valve stem and guide wear by inserting correct valve in guide and moving valve as shown.

Fig. 5-25



3. Measure valve stem oil clearance.
 - (1) Measure inside diameter of valve guide.

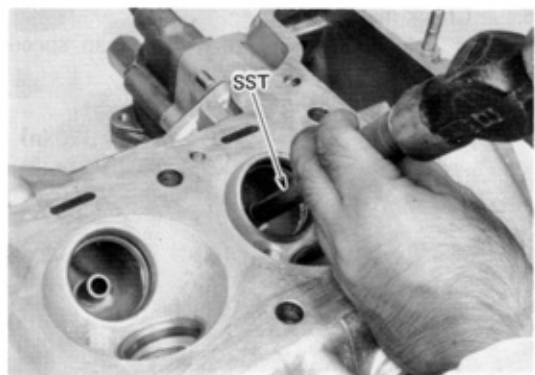
Fig. 5-26



- (2) Measure outside diameter of valve stem.

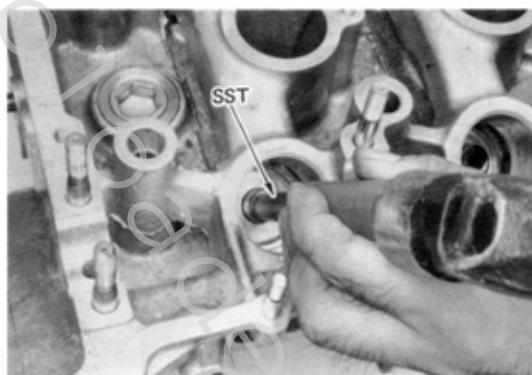
Oil clearance limit**Intake 0.08 mm (0.0032 in)****Exhaust 0.10 mm (0.0039 in)**

Fig. 5-27



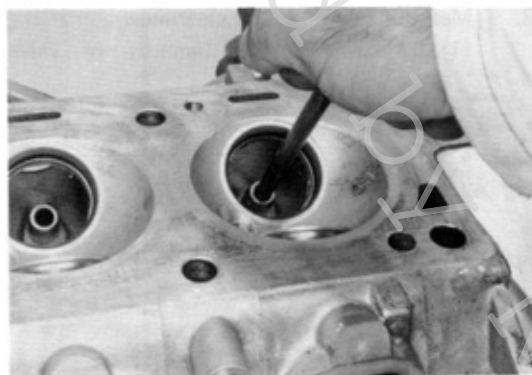
4. Valve guide replacement.
 - (1) Heat cylinder head about 100°C (212°F).
 - (2) Using SST [09201-60011], drive out guide from the combustion chamber toward the top end.

Fig. 5-28



- (3) Drive in new guide with SST [09201-40010] until the snap ring contacts the cylinder head.

Fig. 5-29

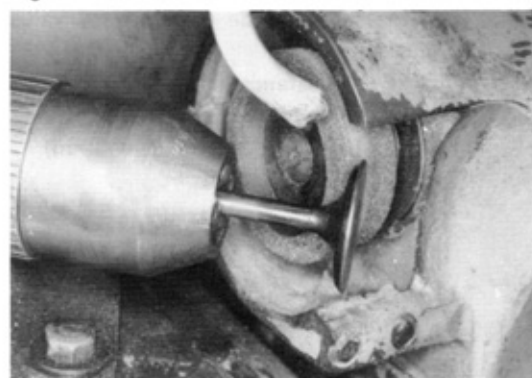


- (4) Using a sharp 8.5 mm reamer, ream guide to obtain specified clearance.

Oil clearance standard

| | |
|----------------|--|
| Intake | 0.02 – 0.05 mm (0.0008 – 0.0020 in) |
| Exhaust | 0.03 – 0.06 mm (0.0012 – 0.0024 in) |

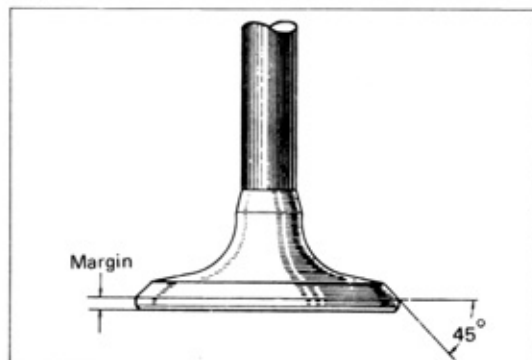
Fig. 5-30



5. Grind all valves.
Remove only enough metal to remove pits and carbon.

Valve face angle : 45°

Fig. 5-31



6. Check margin.
If valve head margin is less than specification, replace valve.

Margin limit

| | |
|----------------|-------------------|
| Intake | 0.5 mm (0.020 in) |
| Exhaust | 0.6 mm (0.024 in) |

Fig. 5-32

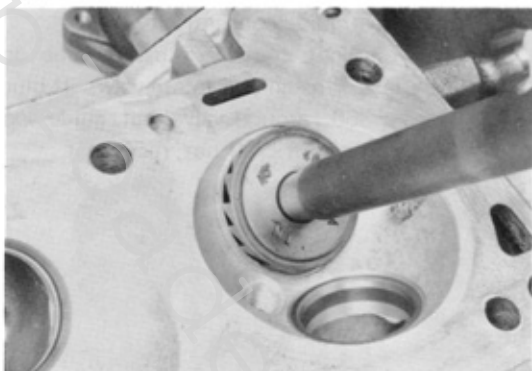


Fig. 5-33



Fig. 5-34

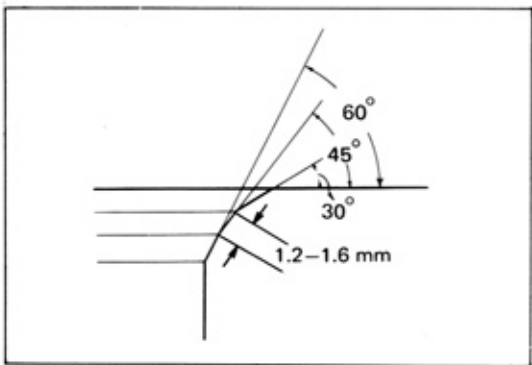


Fig. 5-35



7. Resurface valve seats with 45° carbide cutter.
Remove only enough metal to clean seat.



8. Coat valve face with prussian blue or white lead. Locate contact point on valve by rotating valve against seat.

— Note —

Seat contact should be in middle of valve face with following width:

Intake 1.2 – 1.6 mm (0.047 – 0.063 in)

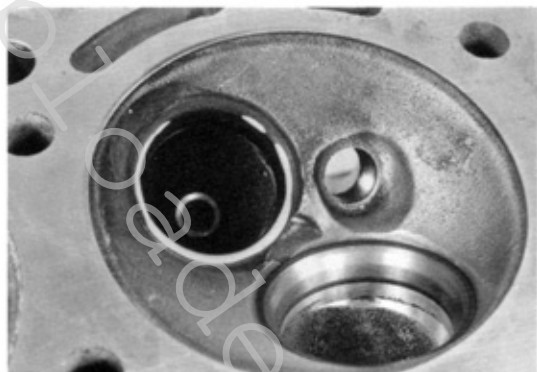
Exhaust 1.2 – 1.6 mm (0.047 – 0.063 in)

9. Correct seat position.
To correct seating that is too high, use 30° and 45° cutters. If seating is too low, use 60° and 45° cutters.



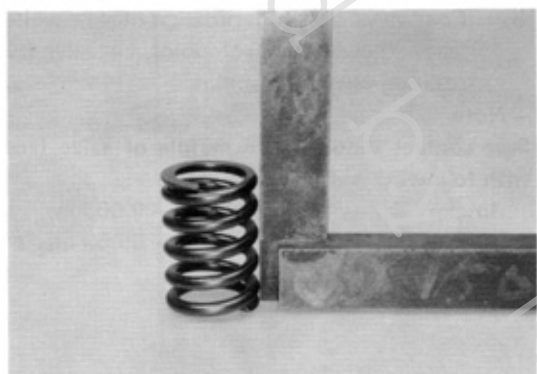
10. Check valve concentricity.
Lightly coat seat with prussian blue. Install valve and rotate. If blue appears 360° around face, valve stem and face are concentric. If not, replace valve.

Fig. 5-36



11. Check seat/guide concentricity. Apply a light coat of prussian blue on valve face. Install and rotate valve. If blue appears 360° around valve seat, guide and seat are concentric. If not, recut seat.

Fig. 5-37

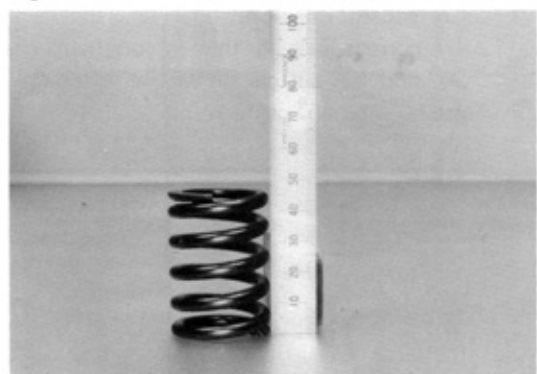


Valve Spring

1. Check squareness of valve springs with steel square. If spring is out of square more than limit, replace.

Squareness Limit (intake, exhaust)
1.6 mm (0.063 in)

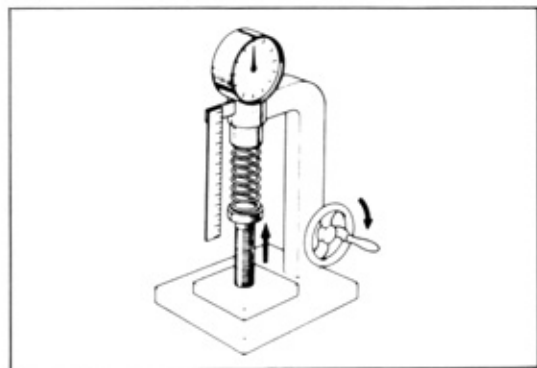
Fig. 5-38



2. Measure free height of all springs. Replace any spring that is out of specification.

Free height (intake, exhaust)
Standard 45.6 mm (1.795 in)

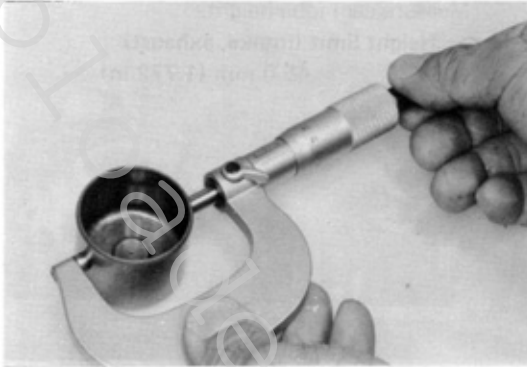
Fig. 5-39



3. Using a spring tester, measure tension of each spring at the specified installed height. Replace any spring that does not meet specification.

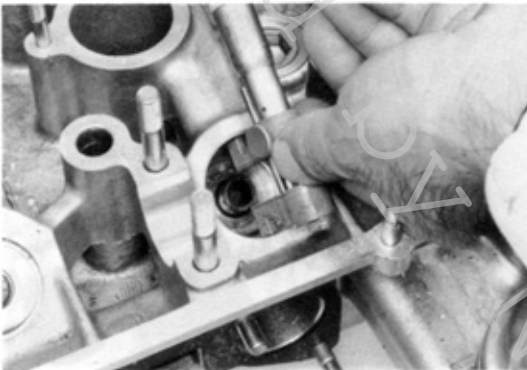
Installed load (intake, exhaust)
Limit 29.5 kg (65.0 lb)
Standard 35.0 kg (77.2 lb)
Installed height
39.0 mm (1.58 in)

Fig. 5-40

**Valve Lifter**

1. Measure valve lifter oil clearance.
 - (1) Measure outside diameter of lifter.

Fig. 5-41

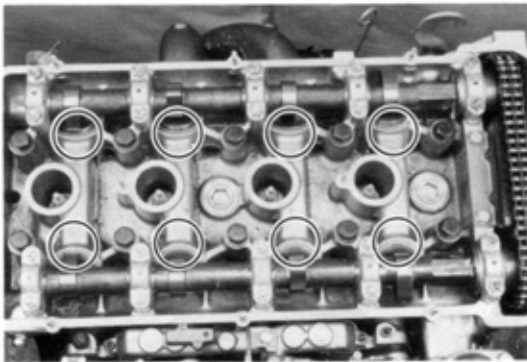


- (2) Measure inside diameter of cylinder head.

Oil clearance limit**0.1 mm (0.004 in)**

Standard 0.02 – 0.03 mm
(0.008 – 0.0012 in)

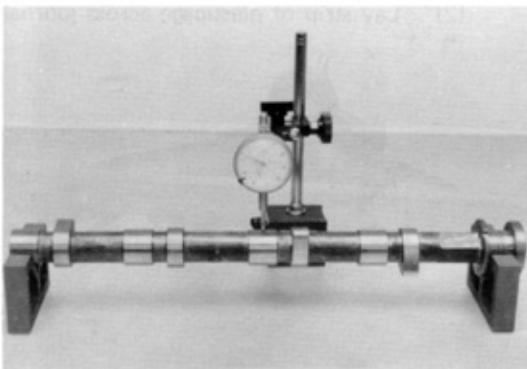
Fig. 5-42



2. Valve lifter selective fits.

| Fit Code (Paint) | Cylinder Head Valve Sleeve Bore | Valve Lifter Outside Diameter |
|------------------|--------------------------------------|--------------------------------------|
| Black | 37.951–37.957 mm (1.4941–1.4944") | 37.925–37.931 mm (1.4931–1.4933") |
| Blue | 37.957–37.963 mm (1.4944–1.4946") | 37.931–37.937 mm (1.4933–1.4936") |
| Yellow | 37.963–37.969 mm (1.4946–1.4948") | 37.937–37.943 mm (1.4936–1.4938") |
| Red | 37.969–37.975 mm (1.4948–1.4951") | 37.943–37.949 mm (1.4938–1.4941") |

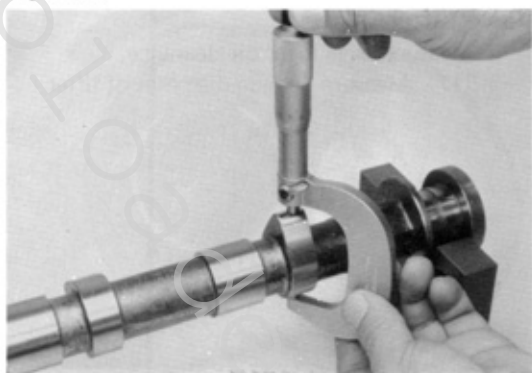
Fig. 5-43

**Camshaft and Bearing**

1. Check camshaft for runout.

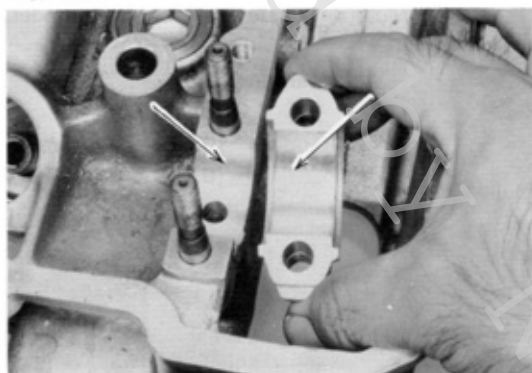
Runout limit 0.03 mm (0.0012 in)

Fig. 5-44



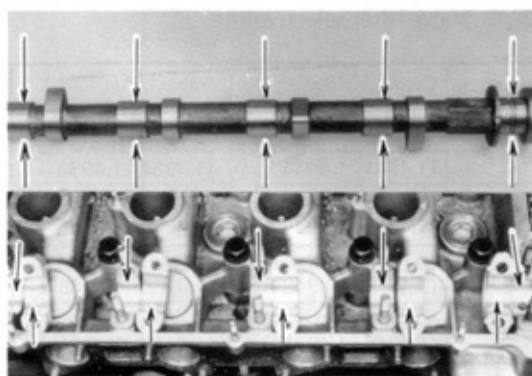
2. Measure cam lobe height.
Height limit (intake, exhaust)
45.0 mm (1.772 in)

Fig. 5-45



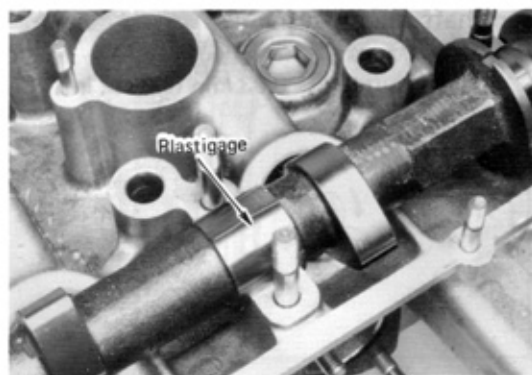
3. Check bearing for flaking or scoring.

Fig. 5-46



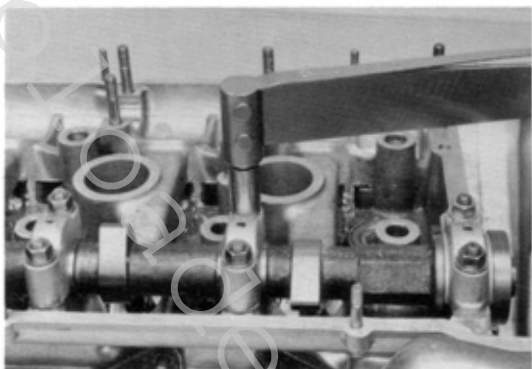
4. Measure camshaft oil clearance.
 (1) Clean bearing and camshaft.

Fig. 5-47



- (2) Lay strip of plastigage across journal.

Fig. 5-48

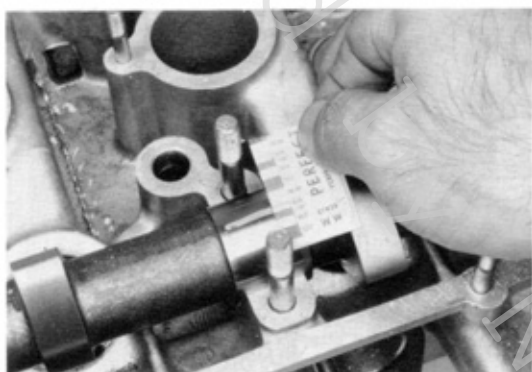


- (3) Tighten cap nuts to specified torque.

Torque 1.7 – 2.3 kg-m
(12.3 – 16.6 ft-lb)

- (4) Remove cap.

Fig. 5-49



- (5) Measure plastigage at its widest point. If clearance is not within specification, replace bearing.

Oil clearance

Limit 0.15 mm (0.0059 in)
Standard 0.05 – 0.09 mm
(0.0020 – 0.0035 in)

Fig. 5-50

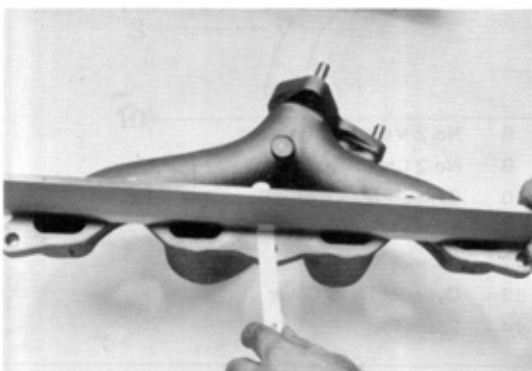


Manifolds

1. Inspect surfaces contacting cylinder head for warpage, and replace if warped over the limit.

Warpage limit 0.1 mm (0.004 in)

Fig. 5-51



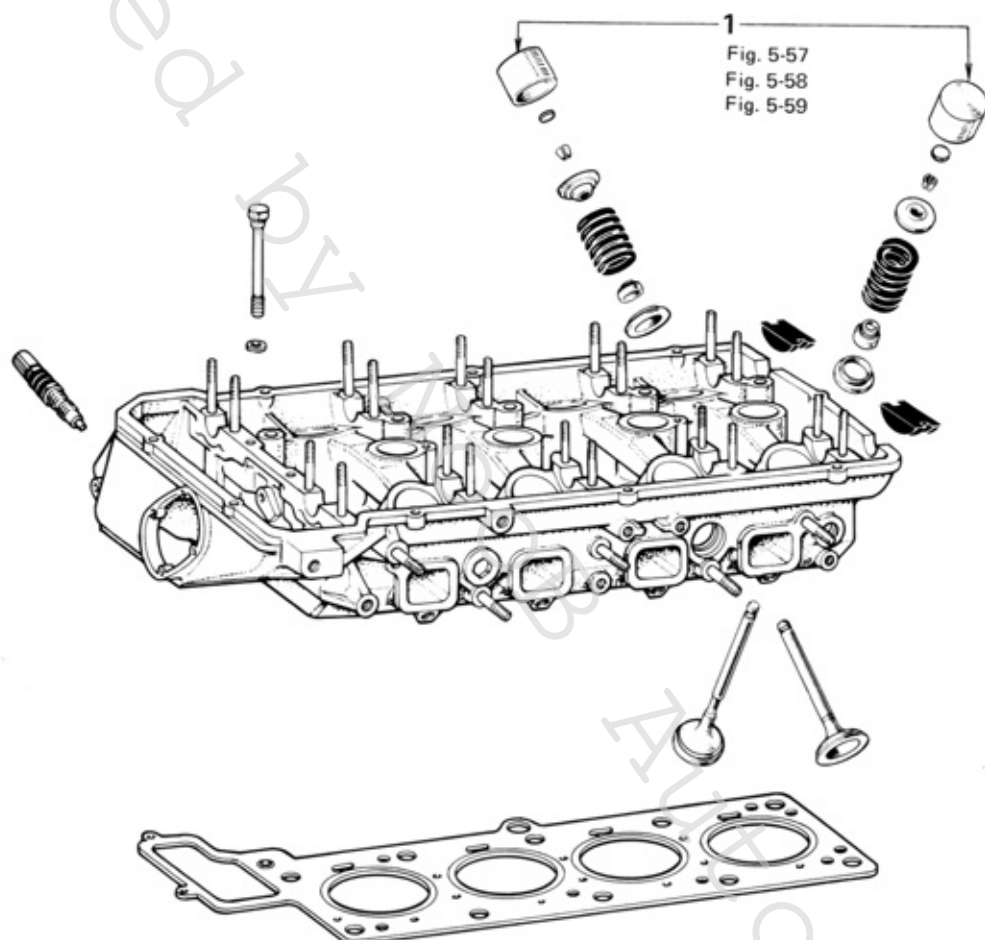
Warpage limit 0.1 mm (0.004 in)

ASSEMBLY

Assemble in numerical order.

Fig. 5-55

- Thoroughly clean the parts to be assembled.
- Apply clean engine oil on the sliding and rotating surfaces of the parts before assembly.



- 1 Valve and Spring
- 2 Cylinder Head
- 3 No.3 Vibration Damper
- 4 Oil Nozzle
- 5 Front Cover
- 6 Camshaft and Bearing Cap
- 7 Camshaft Timing Gear

- 8 No.2 Vibration Damper
- 9 No.2 Chain Tensioner
- 10 Exhaust Manifold
- 11 Intake Manifold and Carburetor
- 12 Balance Tube
- 13 Cylinder Head Cover
- 14 Spark Plug

Fig. 5-56

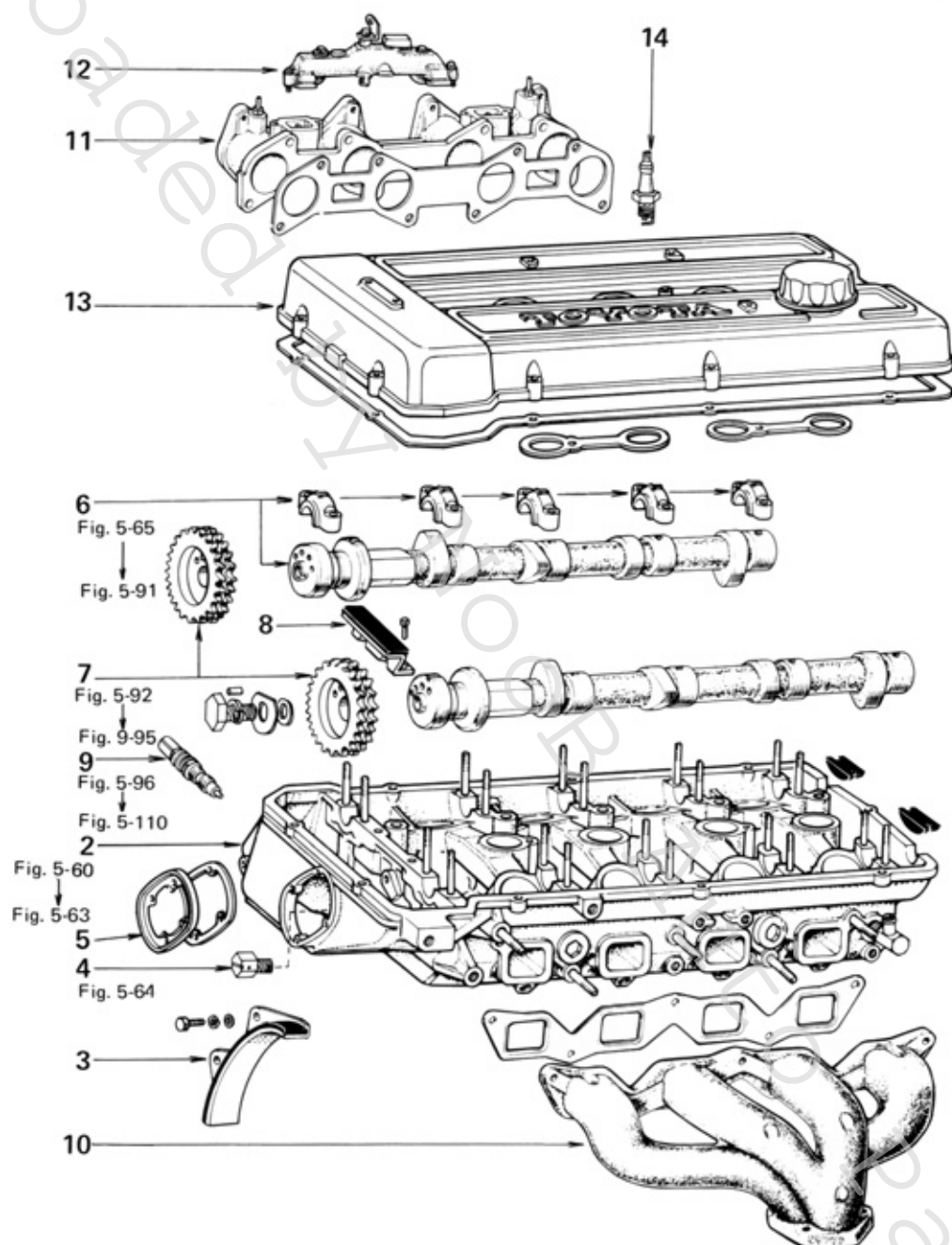
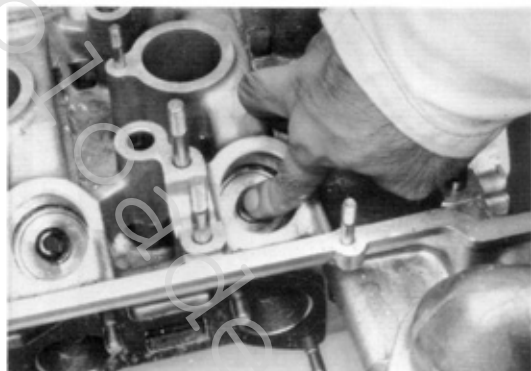
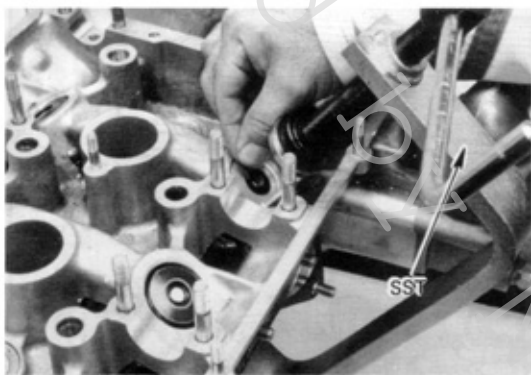


Fig. 5-57



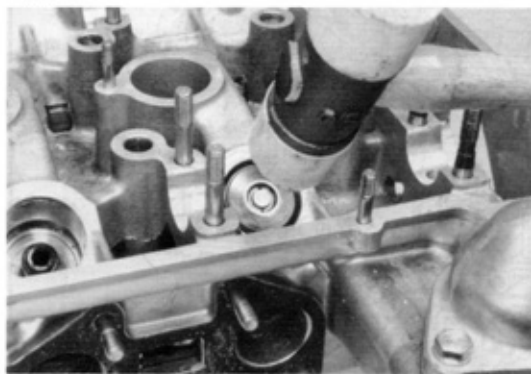
Install oil seal by hand.

Fig. 5-58



Compress the valve spring with SST [09202-43010] and install retainer locks.

Fig. 5-59



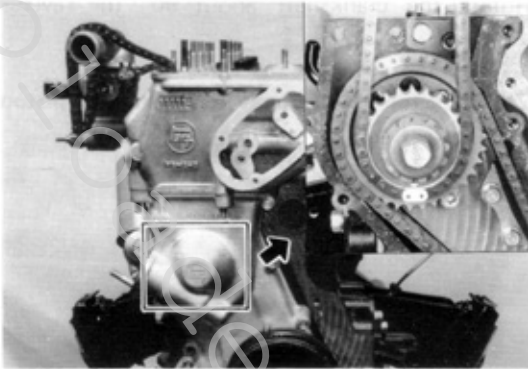
After assembling valve spring, tap stem lightly to assure proper fit.

Fig. 5-60



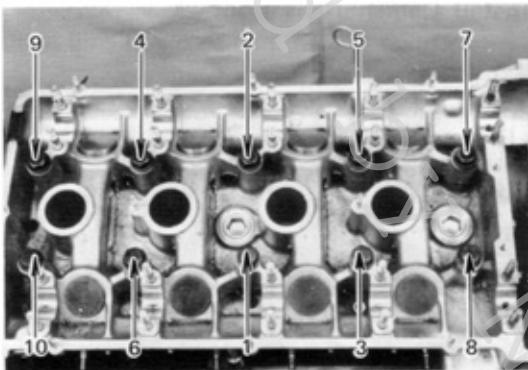
Apply liquid sealer to three points on cylinder head and install gasket.

Fig. 5-61



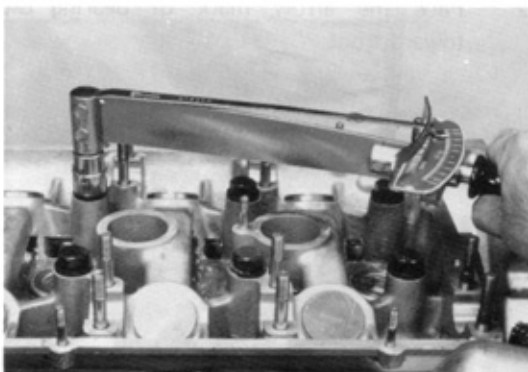
Install cylinder head with No.2 chain will not fall off.

Fig. 5-62



Gradually tighten cylinder head bolts in 2 to 3 stages in the sequence as shown.

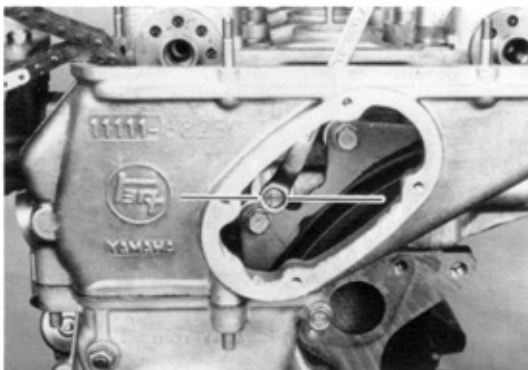
Fig. 5-63



Tighten head bolts to specified torque.

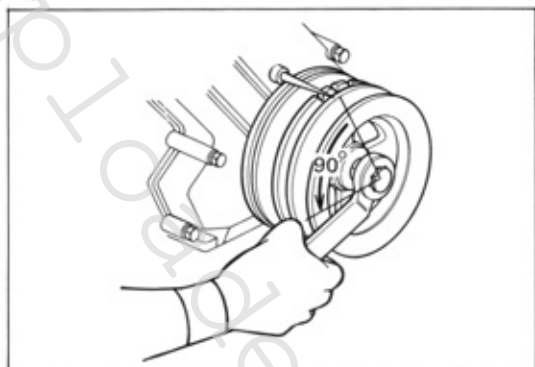
Torque 7.2 – 8.8 kg-m (52.1 – 63.7 ft-lb)

Fig. 5-64



Install the oil nozzle with its slot positioned horizontally.

Fig. 5-65

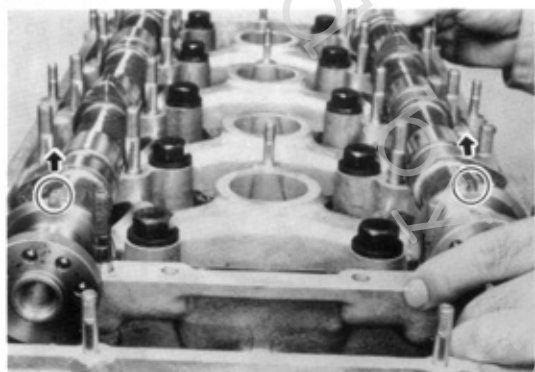


Rotate the crankshaft about 90° the reverse direction.

— Note —

Lower piston to prevent interference of piston head and valve.

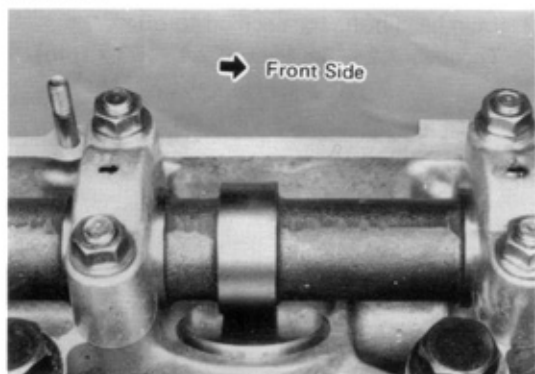
Fig. 5-66



Install Camshaft as Follows

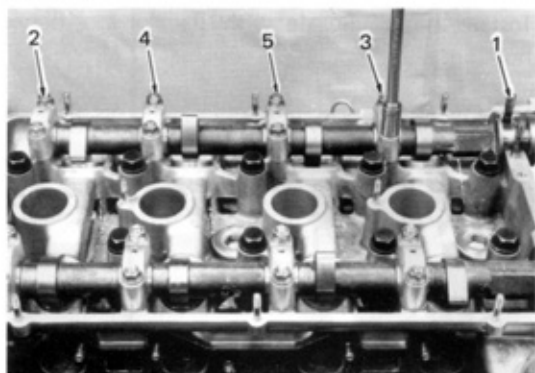
1. Position the camshaft so that the slit in the front end will point upward.

Fig. 5-67



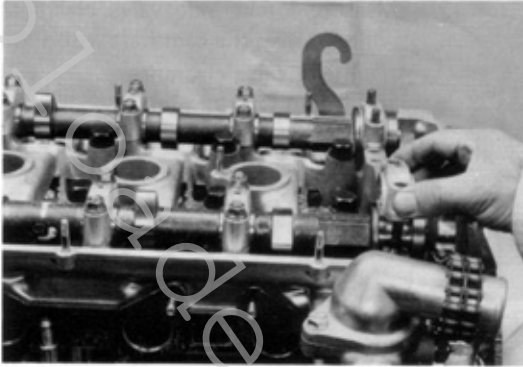
2. Face the arrow mark of bearing cap toward front.

Fig. 5-68



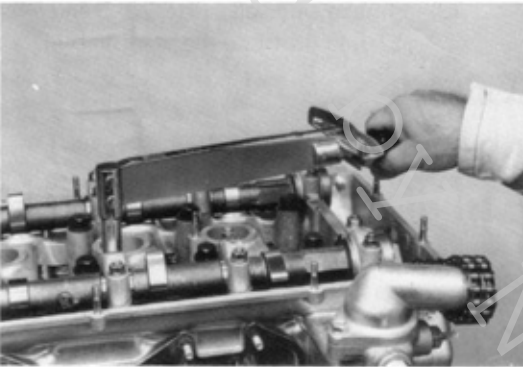
3. Gradually tighten No.2 — No.5 bearing cap bolts in 3 to 4 stages in the sequence as shown.

Fig. 5-69



4. Then, install No.1 bearing cap.

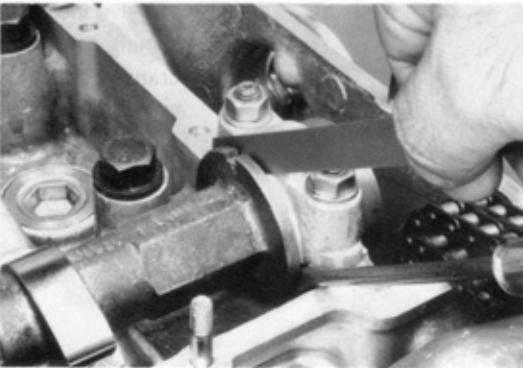
Fig. 5-70



5. Tighten cap nuts to specified torque.

Torque 1.7 – 2.3 kg-m (12.3 – 16.6 ft-lb)

Fig. 5-71



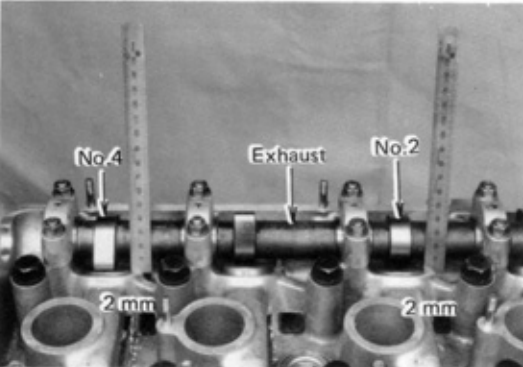
6. Check camshaft thrust clearance.

Thrust clearance

Limit 0.4 mm (0.0158 in)

Standard 0.15 – 0.35 mm
(0.0059 – 0.0138 in)

Fig. 5-72



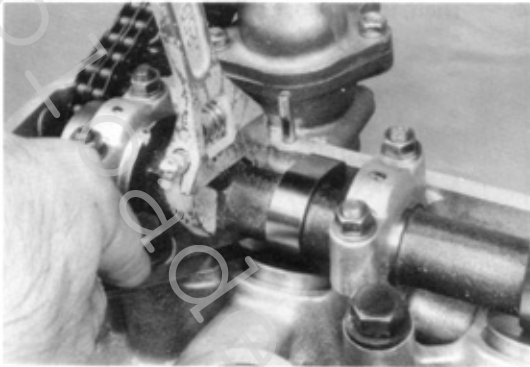
Adjust The Valve Clearance

1. Measure the valve clearance.

(1) Exhaust side valve lifter No.2 and No.4 should protrude the same amount.

(approx. 2 mm)

Fig. 5-73



- (2) Measure intake side valve clearance while turning the camshaft with tool.

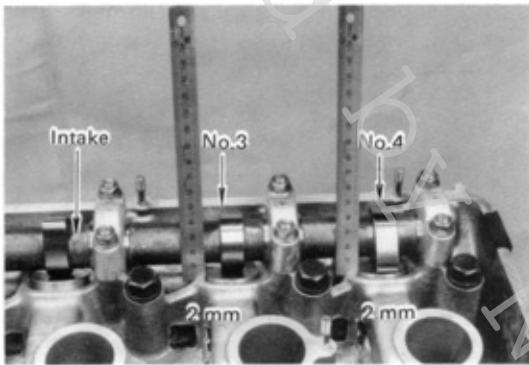
Intake valve clearance

0.26 – 0.32 mm

(0.010 – 0.013 in)

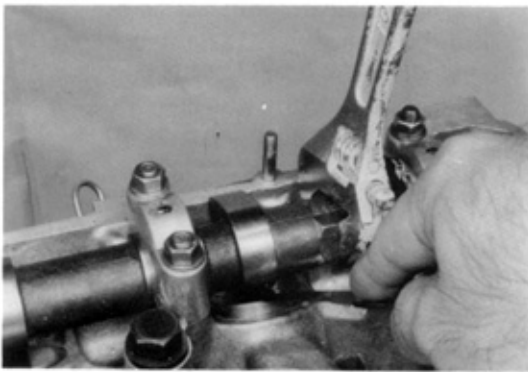
If outside the specified value and record the results.

Fig. 5-74



- (3) Intake side valve lifter No.3 and No.4 should protrude the same amount.

Fig. 5-75



- (4) Measure exhaust side valve clearance while turning the camshaft with tool.

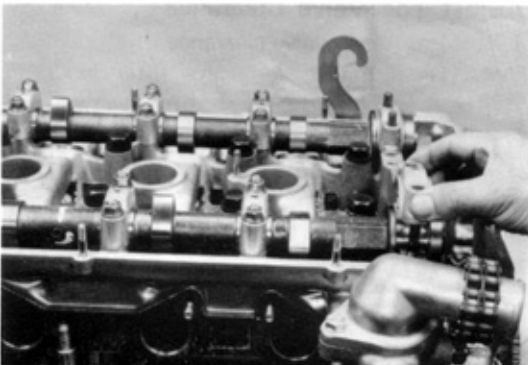
Exhaust valve clearance

0.31 – 0.37 mm

(0.012 – 0.015 in)

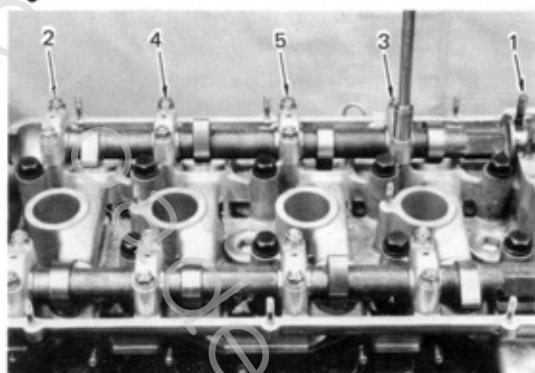
If outside the specified value and record the results.

Fig. 5-76



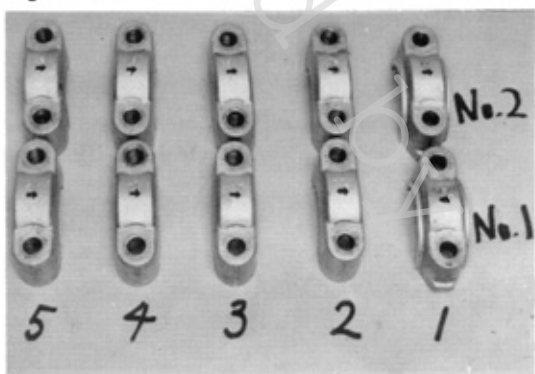
2. Remove No.1 bearing cap.

Fig. 5-77



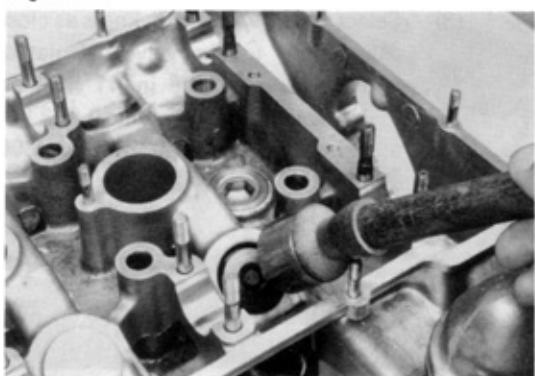
3. Gradually loosen the other cap nuts in 2 to 3 stages in the sequence as shown.

Fig. 5-78



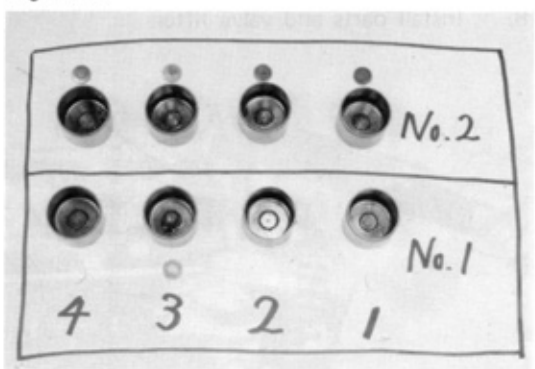
4. Keep bearings and caps in order.

Fig. 5-79



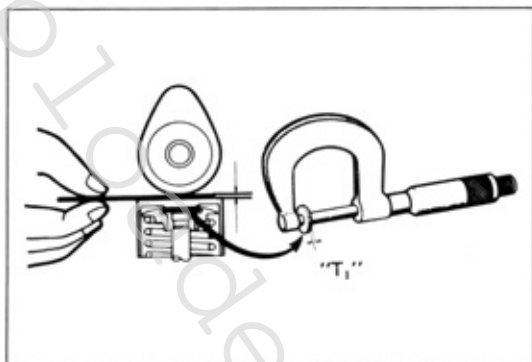
5. Remove valve lifter when valve clearance is not within specified value.

Fig. 5-80



6. Keep valves and adjusting pads in order.

Fig. 5-81

**Intake Side**

$$\text{New Pad Thickness} = T_1 + (A - 0.29 \text{ mm})$$

Exhaust Side

$$\text{New Pad Thickness} = T_1 + (A - 0.34 \text{ mm})$$



7. Select a new pad that will give the specified valve clearance as follows.

(1) Measure the pad that was off with a micrometer.

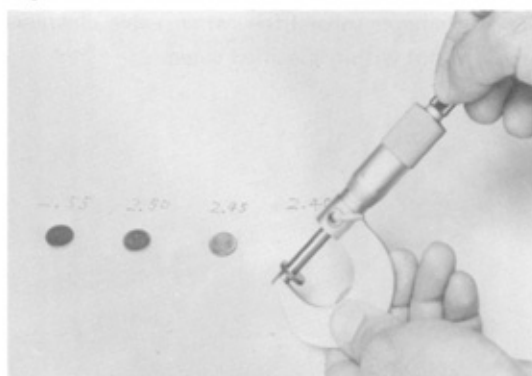


- (2) Calculate thickness of new pad so valve clearance comes within specified valve.

T_1 Thickness of pad used.

A Valve clearance measured.

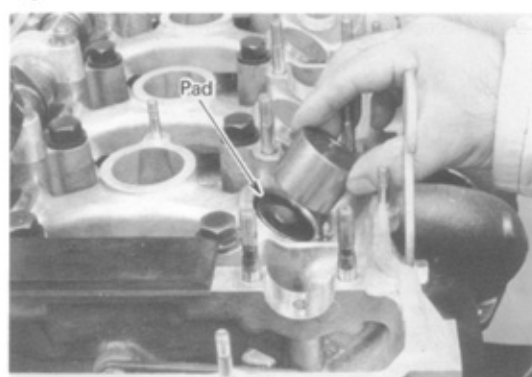
Fig. 5-82



- (3) Select a pad with a thickness as close as possible to the valve calculated.

Pads are available in 41 sizes, in increments of 0.05 mm (0.002 in), from 1.00 mm (0.039 in) to 3.00 mm (0.118 in).

Fig. 5-83



8. Install parts and valve lifter.

Fig. 5-84

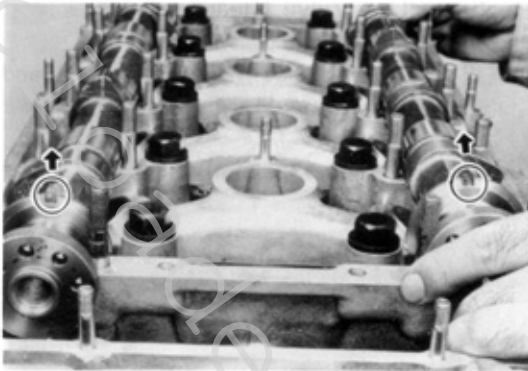


Fig. 5-85

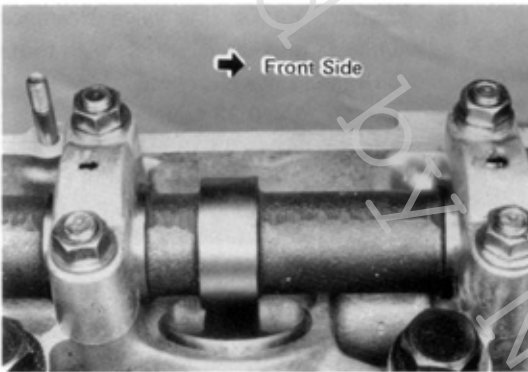


Fig. 5-86

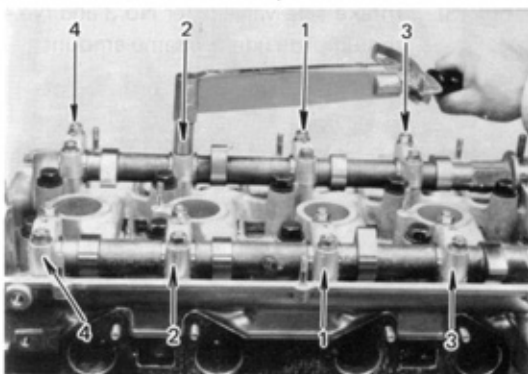
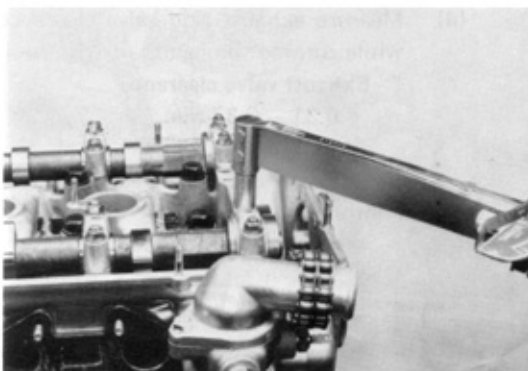


Fig. 5-87

**Install Camshaft as Follows**

1. Position the camshaft so that the slit in the front end will point upward.



2. Face the arrow mark of bearing cap toward front.



3. Gradually tighten No.2 — No.5 bearing cap bolts in 3 to 4 stages in the sequence as shown.



4. Then, install No.1 bearing cap. Tighten cap nuts to specified torque.

Torque 1.7 — 2.3 kg-m
(12.3 — 16.6 ft-lb)

Fig. 5-88

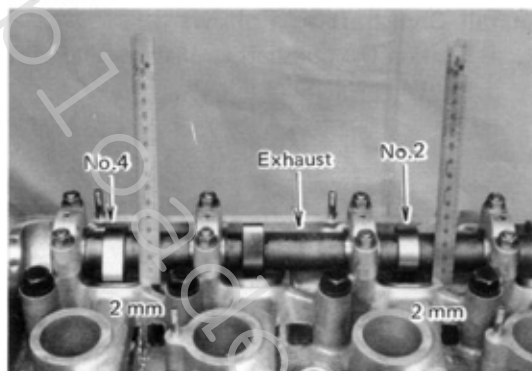


Fig. 5-89

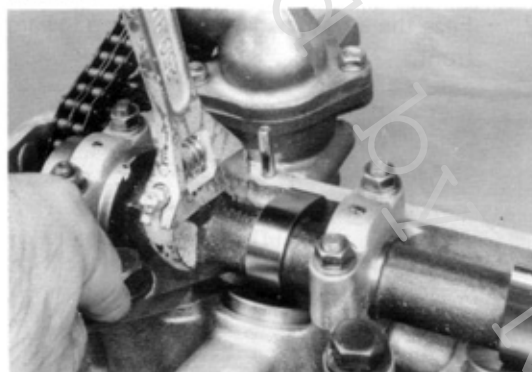


Fig. 5-90

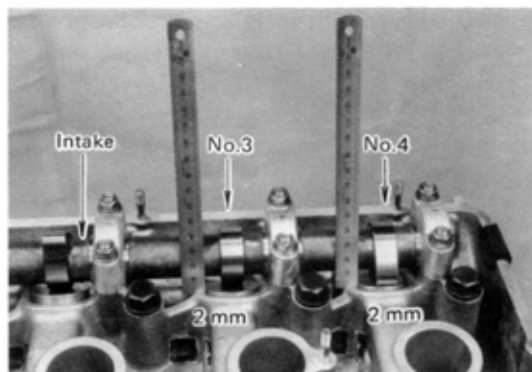
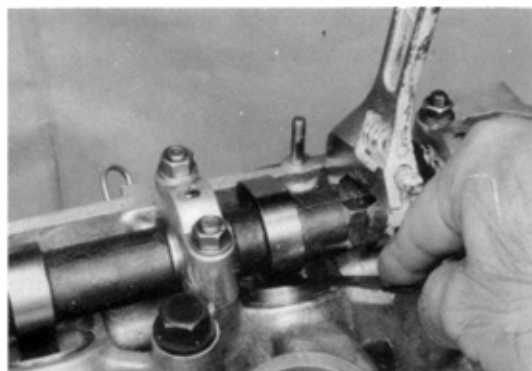


Fig. 5-91

**Recheck The Valve Clearance**

1. Measure the valve clearance.
 - (1) Exhaust side valve lifter No.2 and No.4 should protrude the same amount.

(approx. 2 mm)



- (2) Measure intake side valve clearance while turning the camshaft with tool.

Intake valve clearance

0.26 – 0.32 mm

(0.010 – 0.013 in)

If outside the specified value, choose another pad.



- (3) Intake side valve lifter No.3 and No.4 should protrude the same amount.



- (4) Measure exhaust side valve clearance while turning the camshaft with tool.

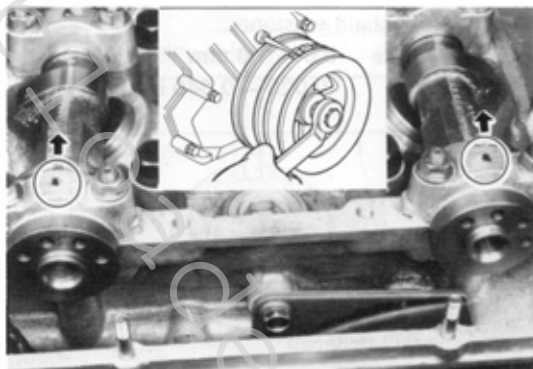
Exhaust valve clearance

0.31 – 0.37 mm

(0.012 – 0.015 in)

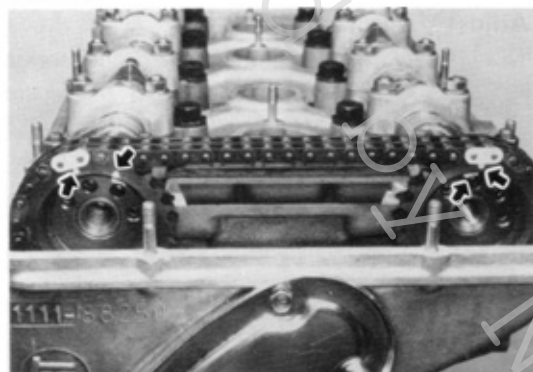
If outside the specified value, choose another pad.

Fig. 5-92



Position the No.1 and No.2 camshaft slit vertically upward with SST [09248-27010]. Set to the No.1 cylinder to TDC/compression.

Fig. 5-93



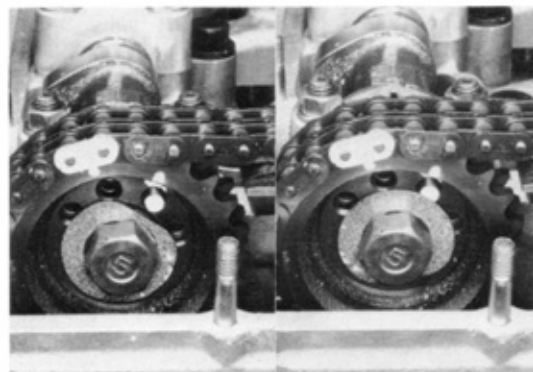
Install the No.2 chain with its mark aligned with the gear mark.

Align camshaft pin hole and gear pin hole to position before disassembly and insert pin.

— Note —

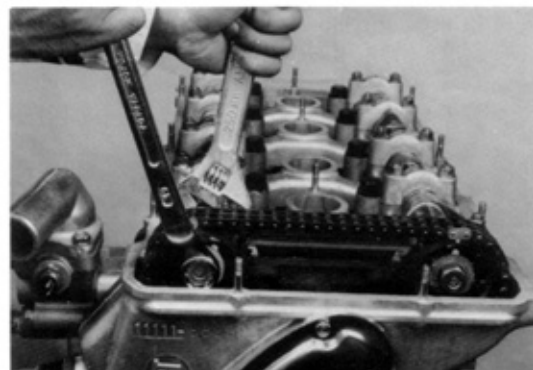
If the pin holes do not line up, turn the camshaft and make the nearest holes line up, but do not turn more than 45°.

Fig. 5-94



Hold the pin with the washer.

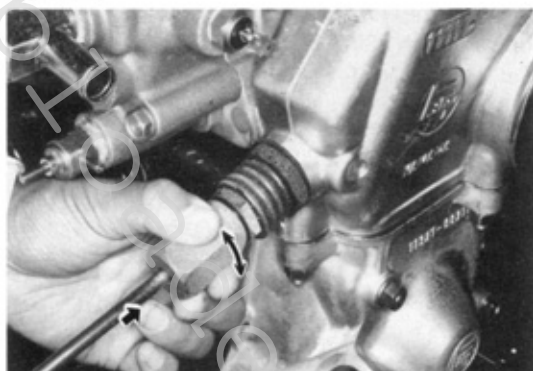
Fig. 5-95



Turn the crankshaft slightly in normal direction, until there is no slack in the pins, gears, and camshafts, and then tighten the bolts to specified torques.

Torque 7.0 – 8.0 kg-m (50.6 – 57.8 ft-lb)

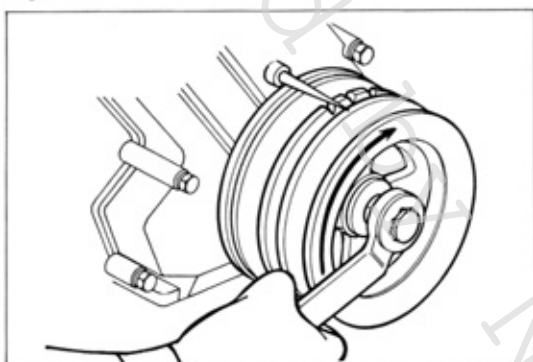
Fig. 5-96



Adjust No.2 chain tensioner.

Back stroke 0.5 — 1.0 mm
(0.020 — 0.040 in)

Fig. 5-97



Adjust Valve Timing

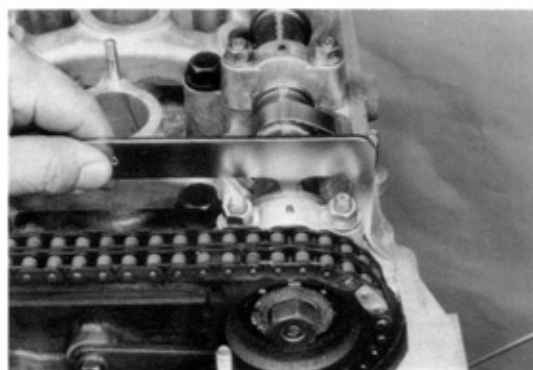
1. Rotate the crankshaft 720° in normal direction until No.1 cylinder TDC/compression.

Fig. 5-98



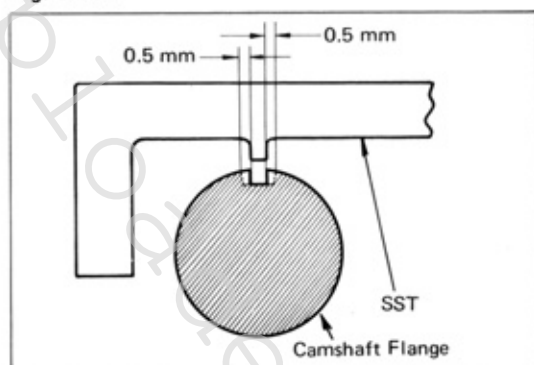
2. Check the No.1 camshaft valve timing with SST [09248-27010].

Fig. 5-99



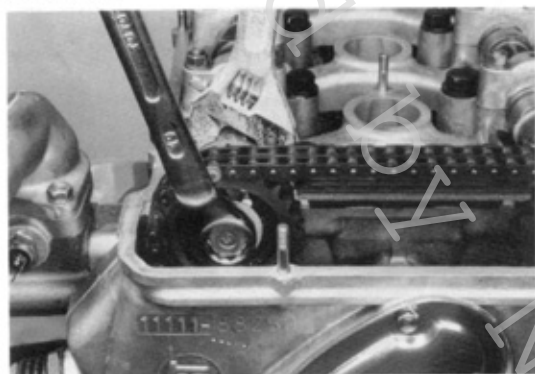
3. Check the No.2 camshaft valve timing with SST [09248-27010].

Fig. 5-100



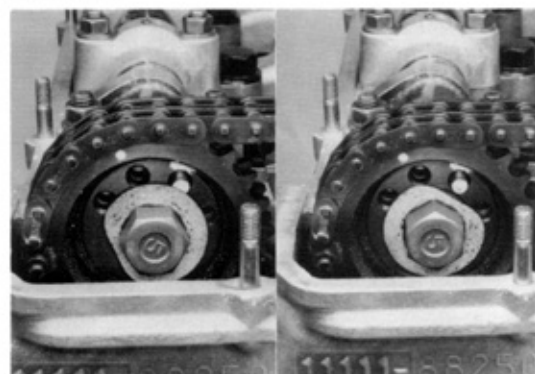
4. Valve timing permissible, error.
 $\pm 2^\circ$ Camshaft rotation angle.
 ± 0.5 mm Camshaft flange outer perimeter.
 Adjust valve timing if it is off.

Fig. 5-101



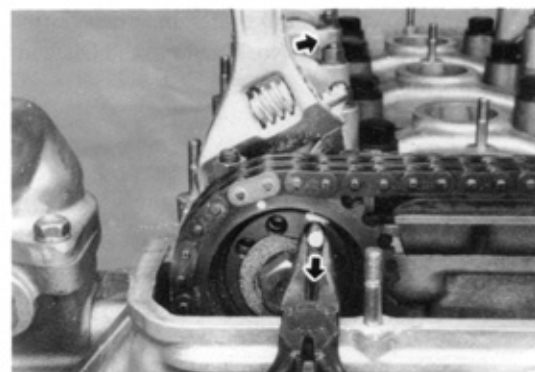
5. Loosen the camshaft mounting bolt.

Fig. 5-102



6. Shift the washer.

Fig. 5-103



7. It will be easier to pull out the pin if the camshaft is turned slightly in the forward direction so as to provide play.

Fig. 5-104

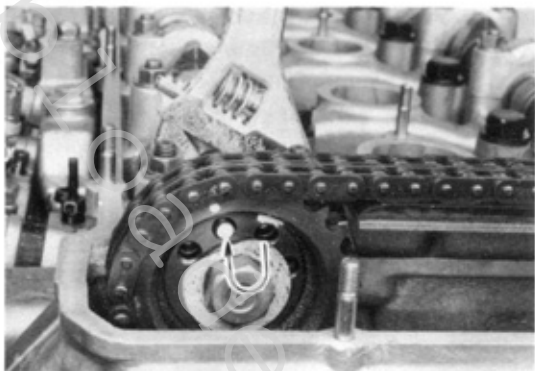


Fig. 5-105

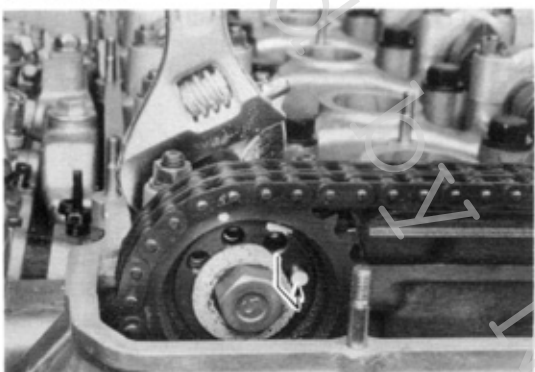


Fig. 5-106

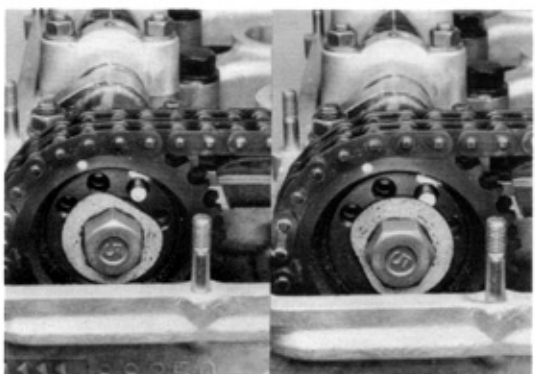
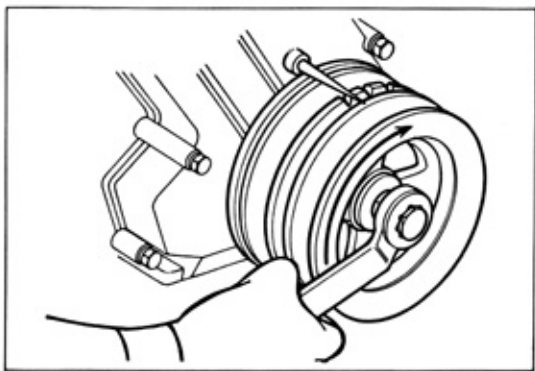


Fig. 5-107



8. When valve timing is advanced.
 - (1) Align with pin hole in counter-clockwise direction.
 - (2) Turn the camshaft so that its slit will be lined up with the adjust gauge and reinsert the pin.

9. When valve timing is retarded.
 - (1) Align with hole pin in clockwise direction.
 - (2) Turn the camshaft so that its slit will be lined up with the adjust gauge and reinsert the pin.



10. Hold the pin with the washer and tighten the bolt.



11. Rotate the crankshaft in the normal direction until No.1 cylinder TDC/compression.

Fig. 5-108

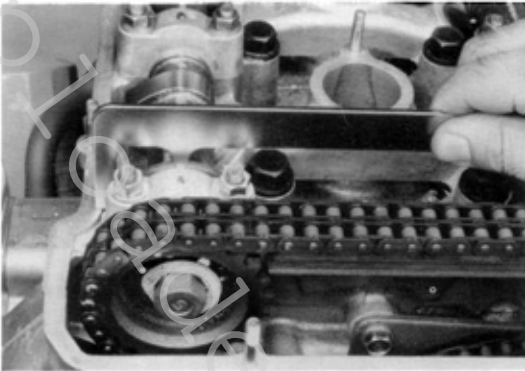


Fig. 5-109

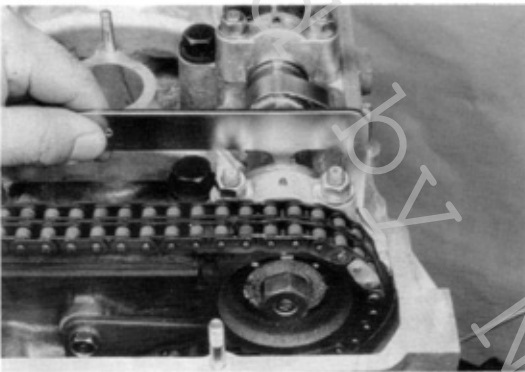
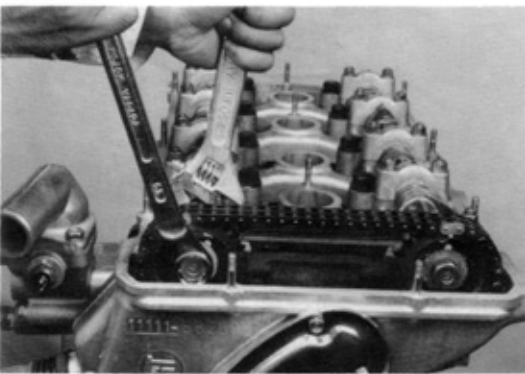


Fig. 5-110



12. Recheck the No.1 camshaft valve timing with SST [09248-27010]. Camshaft slit and SST protrusion should match up.



13. Recheck the No.2 camshaft valve timing with SST [09248-27010]. Camshaft slit and SST protrusion should match up.



14. Tightening torque
7.0 – 8.0 kg-m (50.6 – 57.9 ft-lb)

TIMING CHAIN DISASSEMBLY

Disassemble in numerical order.

Fig. 5-115

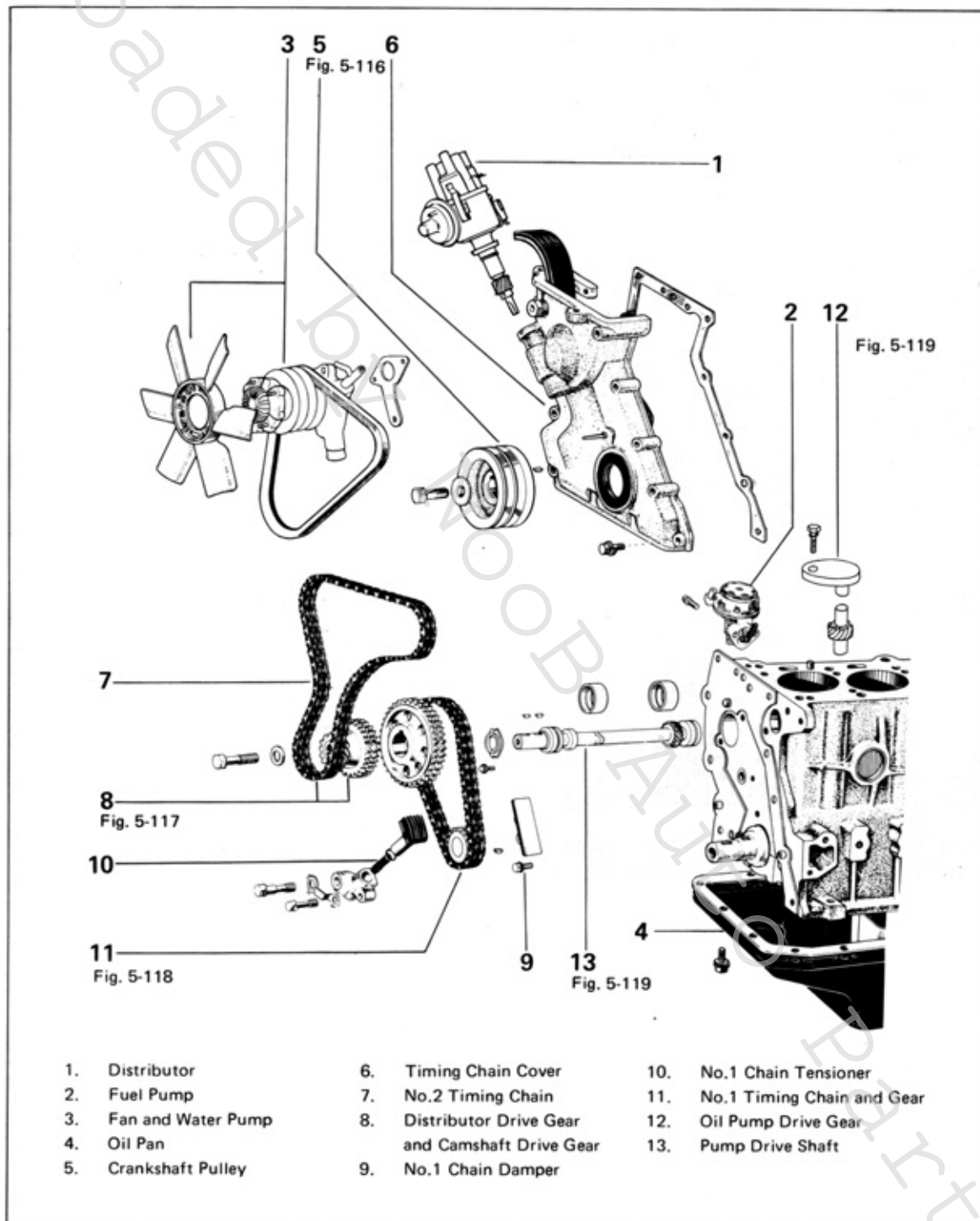
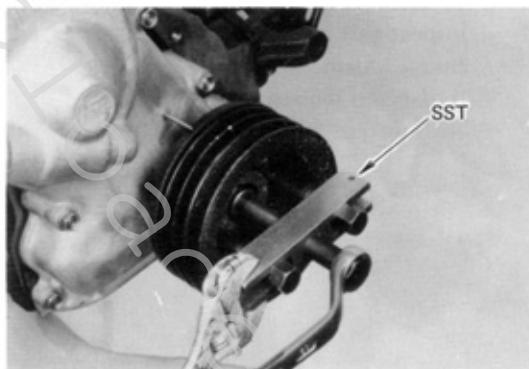
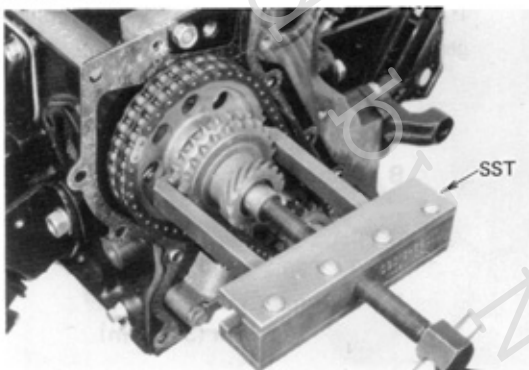


Fig. 5-116



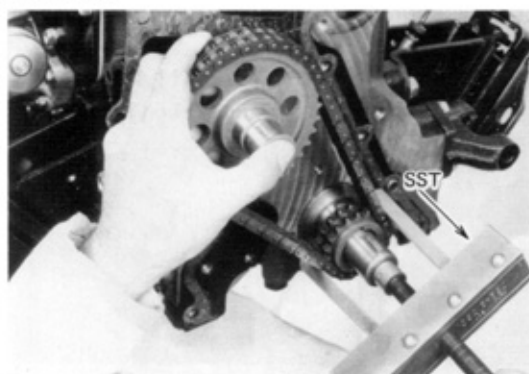
Pull out crankshaft pulley.
Use SST [09213-31021].

Fig. 5-117



Pull out distributor drive gear and camshaft drive gear.
Use SST [09213-36010].

Fig. 5-118



When removing these gears, hook the SST alternately on the two gears and pull them out uniformly.

Fig. 5-119



Remove pump driveshaft from cylinder block before removing pump driveshaft gear.

Fig. 5-120

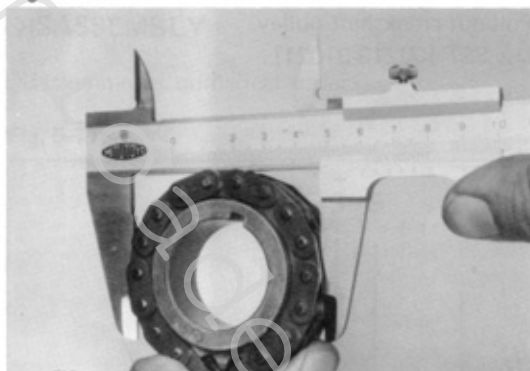


Fig. 5-121

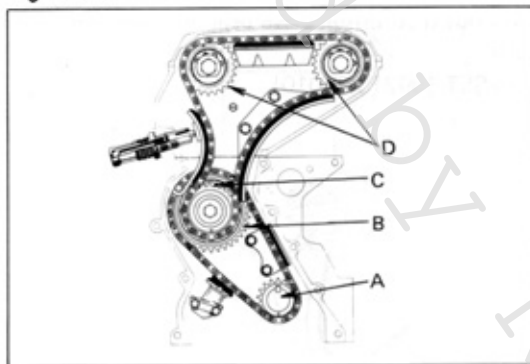


Fig. 5-122

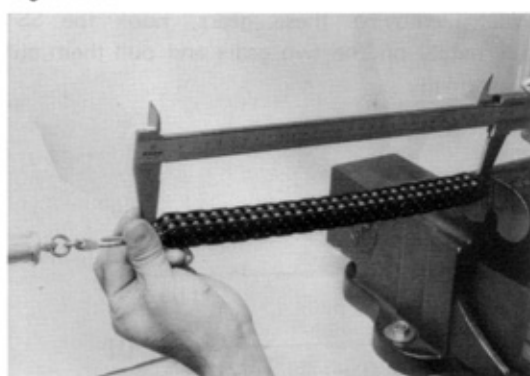


Fig. 5-123



INSPECTION AND REPAIR

Timing Gear and Chain



1. Inspect gear and chain for cracks, wear, and chipped teeth.
If damaged replace gears and chain.
2. Measure gear for wear as shown.

If measurement is below limit, replace gears and chain.

Wear limit

- A : Crankshaft gear
60.0 mm (2.362 in)
- B : Pump driveshaft gear
114.5 mm (4.508 in)
- C : Camshaft drive gear
78.2 mm (3.079 in)
- D : Camshaft timing gear
78.2 mm (3.079 in)



3. Measure No.1 timing chain for elongation.

Elongation limit

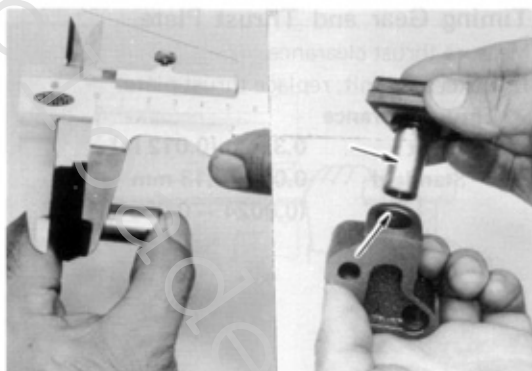
- 291.4 mm (11.47 in)
tension at 5 kg (11 lb)



4. Measure No.2 timing chain for elongation. Measure the length of 17 links with the chain stretched tight with the force of one hand.
Make the same measurements at more than three other places selected at random.

- Elongation limit (at 17 links)
147 mm (5.787 in)

Fig. 5-124

**No.1 Chain Tensioner**

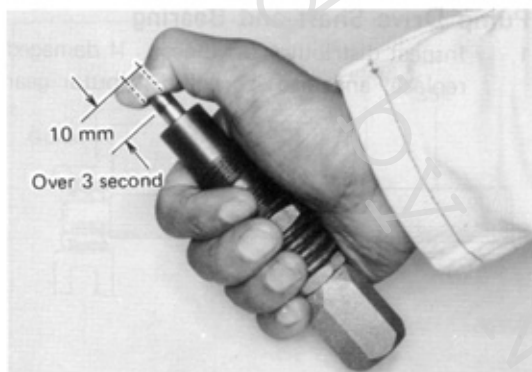
Inspect body and plunger for wear.
Measure tensioner head as shown.



If worn below limit, replace unit.

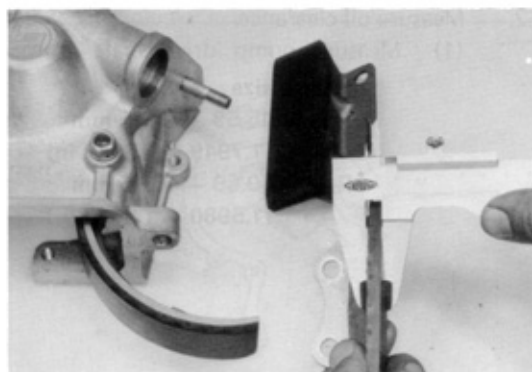
Wear limit 11.5 mm (0.453 in)

Fig. 5-125

**No.2 Chain Tensioner****Air Seal Test**

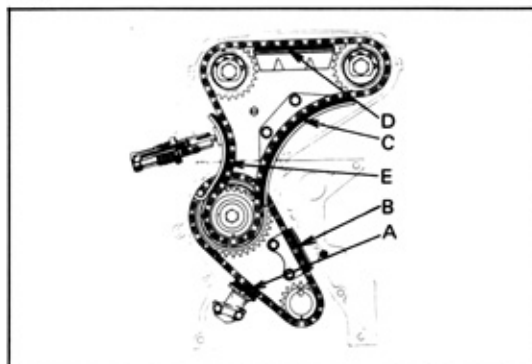
1. Immerse plunger in engine oil and work so as to remove the air.
2. Press plunger with thumb ; 10 mm (0.39 in) stroke should take 3 seconds or more.

Fig. 5-126

**Chain Damper and Slipper**

Inspect chain dampers for wear. Measure each damper.

Fig. 5-127

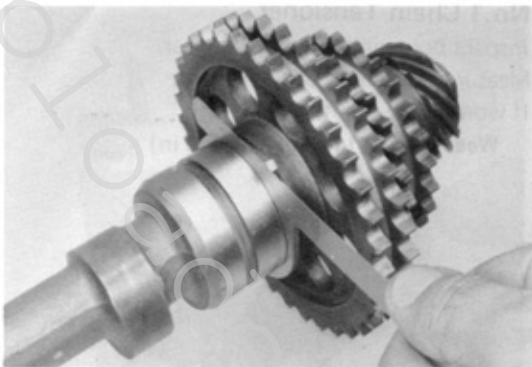


If either is visibly worn or measures less than limit, replace units.

Wear limit

| | |
|------------------------------------|--------------------------|
| A : No.1 chain tensioner | 11.5 mm (0.45 in) |
| B : No.1 chain damper | 5.0 mm (0.20 in) |
| C : No.3 chain damper | 6.5 mm (0.26 in) |
| D : No.2 chain damper | 5.5 mm (0.22 in) |
| E : Chain tensioner slipper | 7.5 mm (0.30 in) |

Fig. 5-128

**Timing Gear and Thrust Plate**

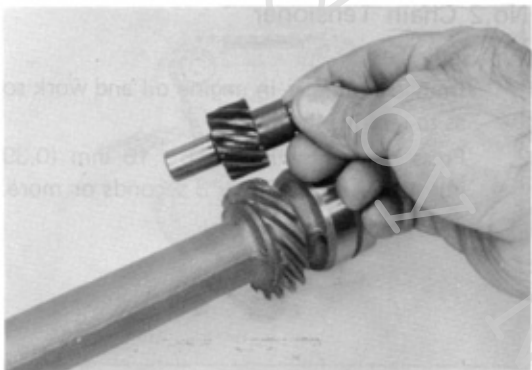
Measure thrust clearance.

If it exceeds limit, replace thrust plate.

Thrust clearance

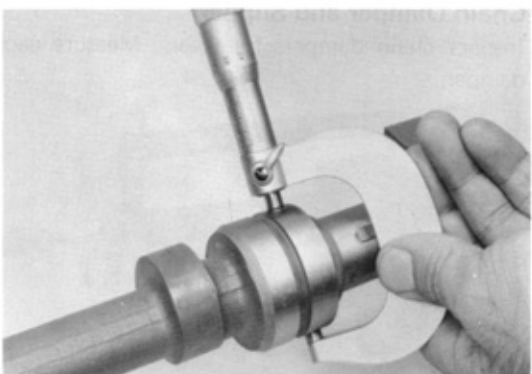
| | |
|-----------------|--|
| Limit | 0.3 mm (0.012 in) |
| Standard | 0.06 – 0.13 mm (0.0024 – 0.0051 in) |

Fig. 5-129

**Pump Drive Shaft and Bearing**

1. Inspect distributor drive gear. If damaged, replace, and also inspect distributor gear.

Fig. 5-130



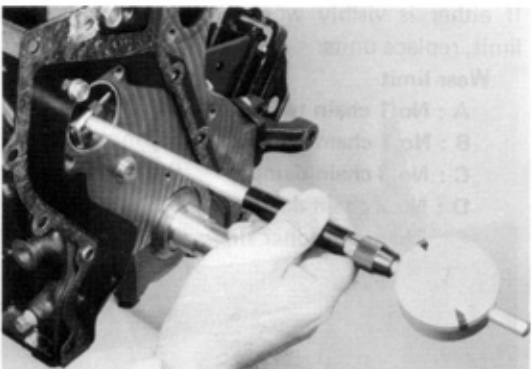
2. Measure oil clearance.

- (1) Measure pump drive shaft journal.

Finished size

| | |
|--------------|--|
| Front | 45.59 – 45.75 mm (1.7949 – 1.8012 in) |
| Rear | 40.59 – 40.75 mm (1.5980 – 1.6043 in) |

Fig. 5-131

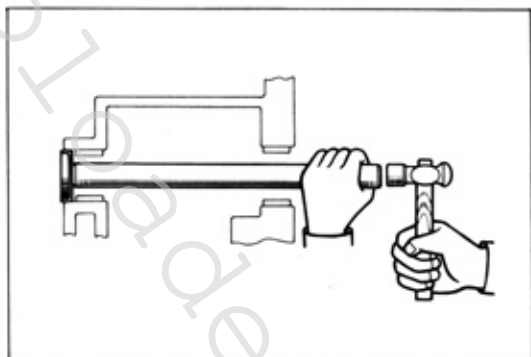


- (2) Measure inner diameter of bearing.

Oil clearance

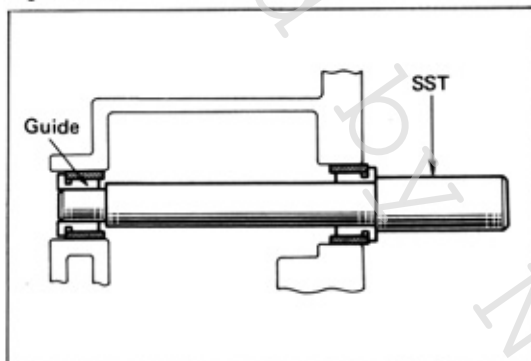
| | |
|-----------------|--|
| Limit | 0.08 mm (0.0032 in) |
| Standard | 0.03 – 0.07 mm (0.0008 – 0.0024 in) |

Fig. 5-132



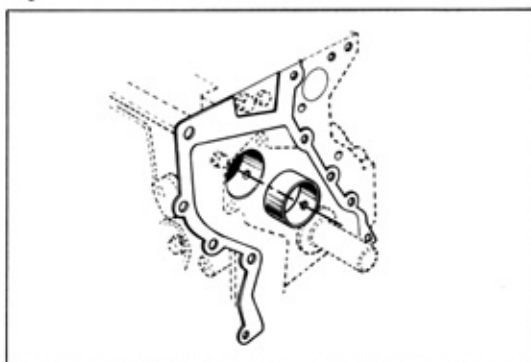
3. Bearing replacement.
(1) Drive out plug from cylinder block.

Fig. 5-133



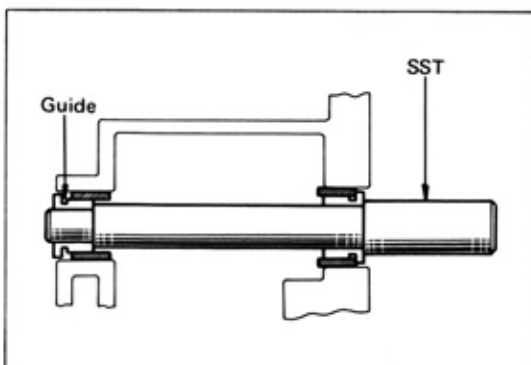
- (2) Remove front bearing.
Use SST [09233-33010] as shown.

Fig. 5-134



- (3) Align bearing oil hole.

Fig. 5-135



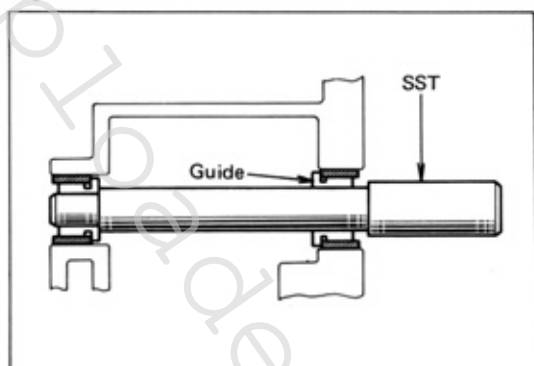
- (4) Install front bearing.
Use SST [09233-33010] as shown.

Bearing fitting tolerance

0.02 – 0.06 mm

(0.0008 – 0.0024 in)

Fig. 5-136



- (5) Remove rear bearing.
Replacement for rear bearing as same as front bearing.
- (6) Install new plug applied with liquid sealer.

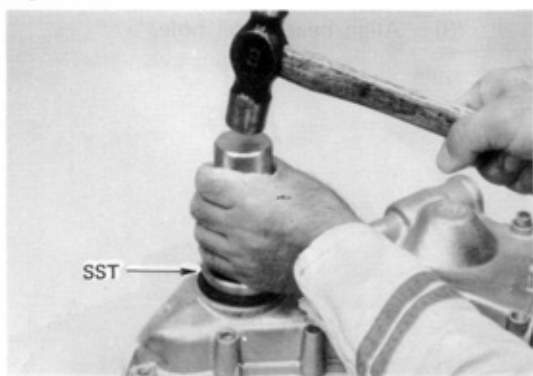
Fig. 5-137



Crankshaft Front Oil Seal

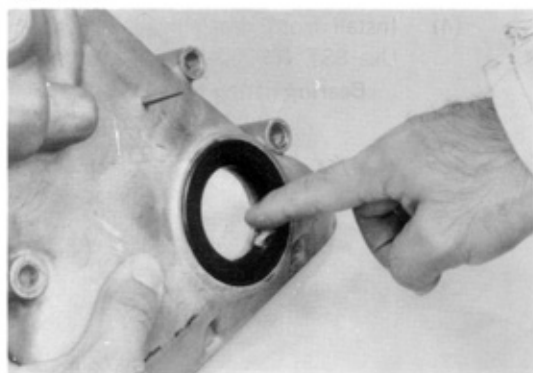
1. Inspect oil seal lip for wear and deformation, and also inspect crankshaft.
2. Oil seal replacement.
 - (1) Remove oil seal with a screwdriver.

Fig. 5-138



- (2) Install new oil seal.
Use SST [09223-50010] as shown.

Fig. 5-139



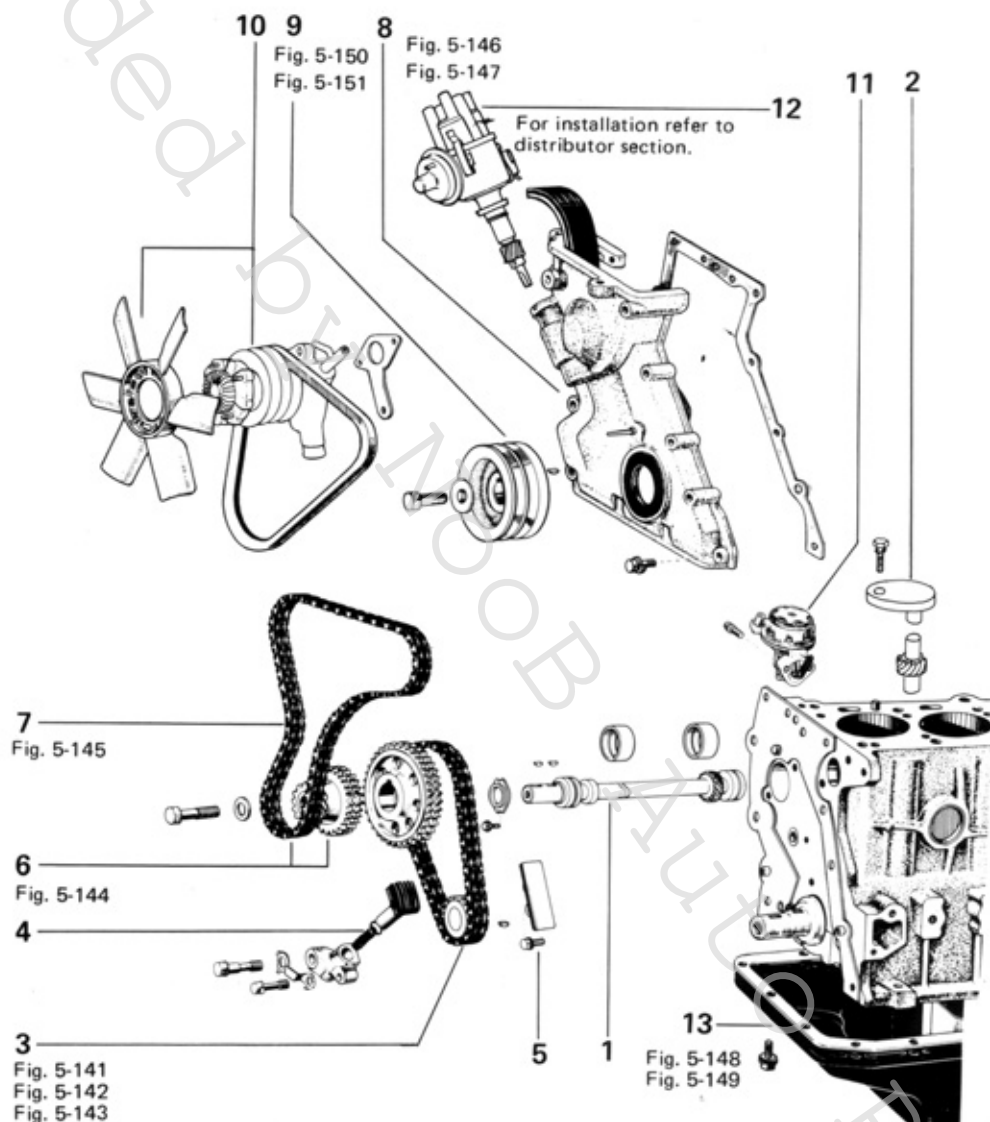
- (3) After driving in the seal, be sure to coat the seal lip lightly with MP grease.

ASSEMBLY

Assemble in numerical order.

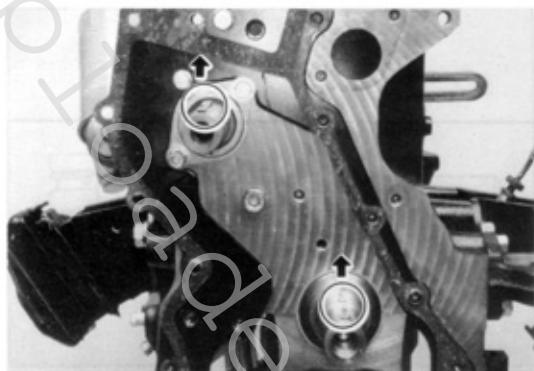
Fig. 5-140

- Thoroughly clean the parts to be assembled.
- Apply clean engine oil on the sliding and rotating surfaces of the parts before assembly.



- | | | |
|-------------------------------|---|------------------------|
| 1. Pump Drive Shaft | 6. Distributor Drive Gear and Camshaft Drive Gear | 10. Water Pump and Fan |
| 2. Oil Pump Drive Gear | 7. No.2 Timing Chain | 11. Fuel Pump |
| 3. No.1 Timing Chain and Gear | 8. Timing Gear Cover | 12. Distributor |
| 4. No.1 Chain Tensioner | 9. Crankshaft Pulley | 13. Oil Pan |
| 5. No.1 Chain Damper | | |

Fig. 5-141



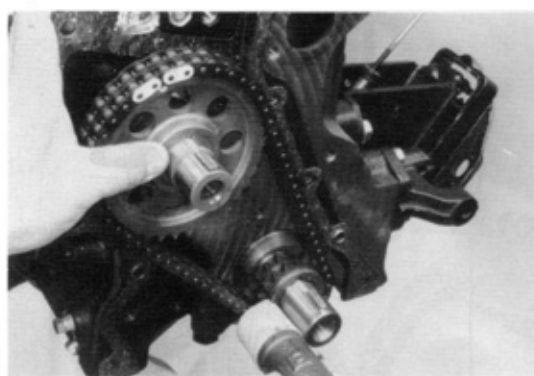
Set the crankshaft keyway and the pump drive shaft keyway vertically upward.

Fig. 5-142



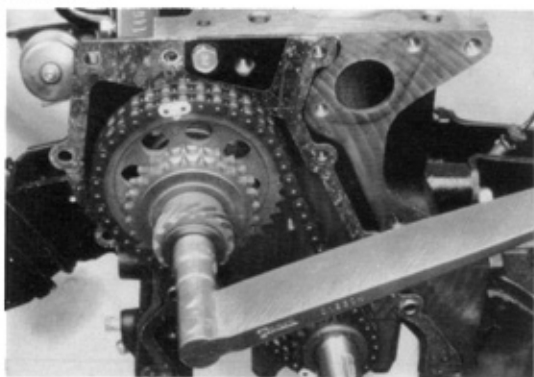
Assemble the crankshaft gear and pump drive shaft gear to the No. 1 chain so that their respective marks are aligned.

Fig. 5-143



Drive in two gears simultaneously to shafts.

Fig. 5-144

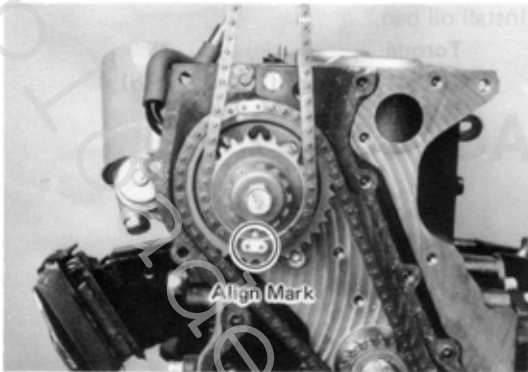


Tighten camshaft drive gear bolt.

Torque

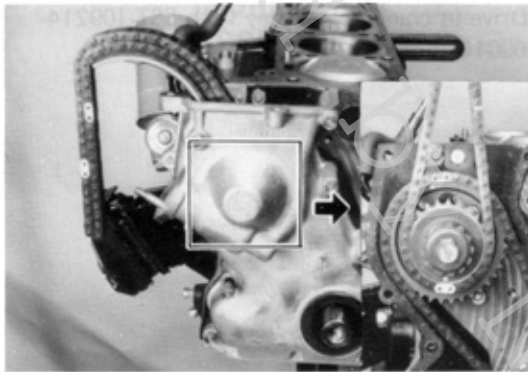
6.0–7.0 kg-m (43.4–50.6 ft-lb)

Fig. 5-145



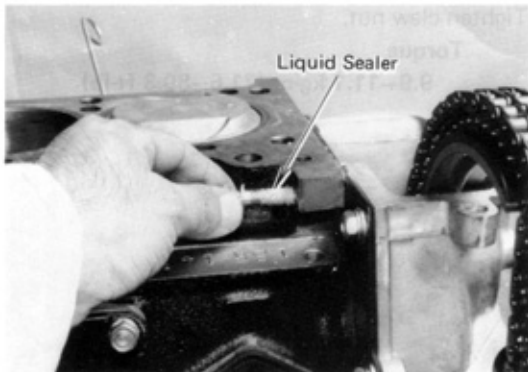
Install No. 2 chain aligned with the chain and gear marks.

Fig. 5-146



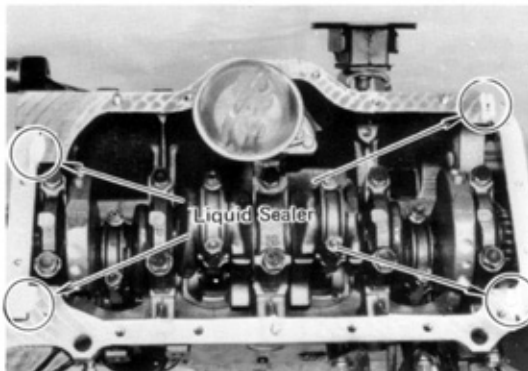
Be careful not to fall the No. 2 chain into the cover.

Fig. 5-147



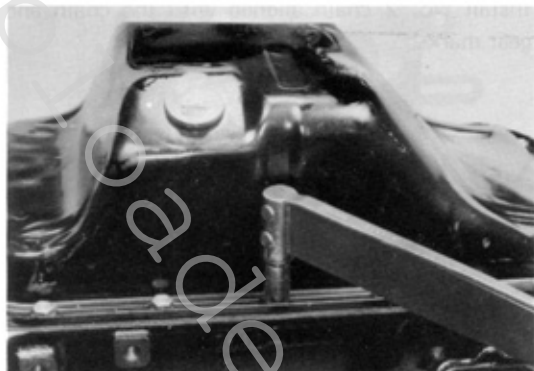
In installing the upper right bolt for mounting the chain cover, insert seal washer and apply liquid sealer on the threads.

Fig. 5-148



Apply liquid sealer as shown.

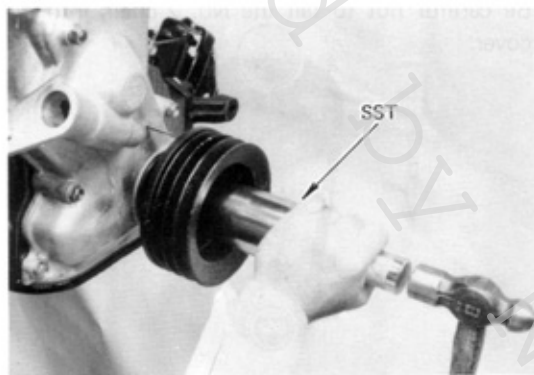
Fig. 5-149



Install oil pan.

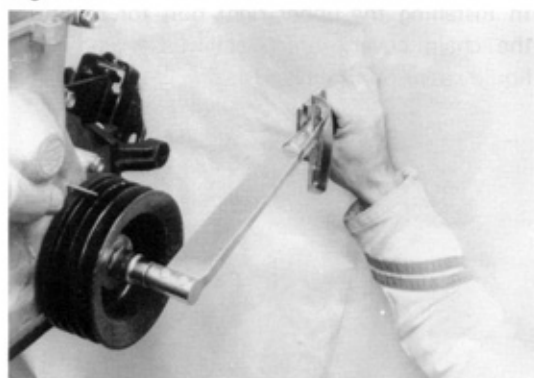
Torque**0.4–0.8 kg-m (2.9–5.8 ft-lb)**

Fig. 5-150



Drive in crankshaft pulley with SST [09214-60010].

Fig. 5-151



Tighten claw nut.

Torque**9.9–11.1 kg-m (71.6–80.3 ft-lb)**

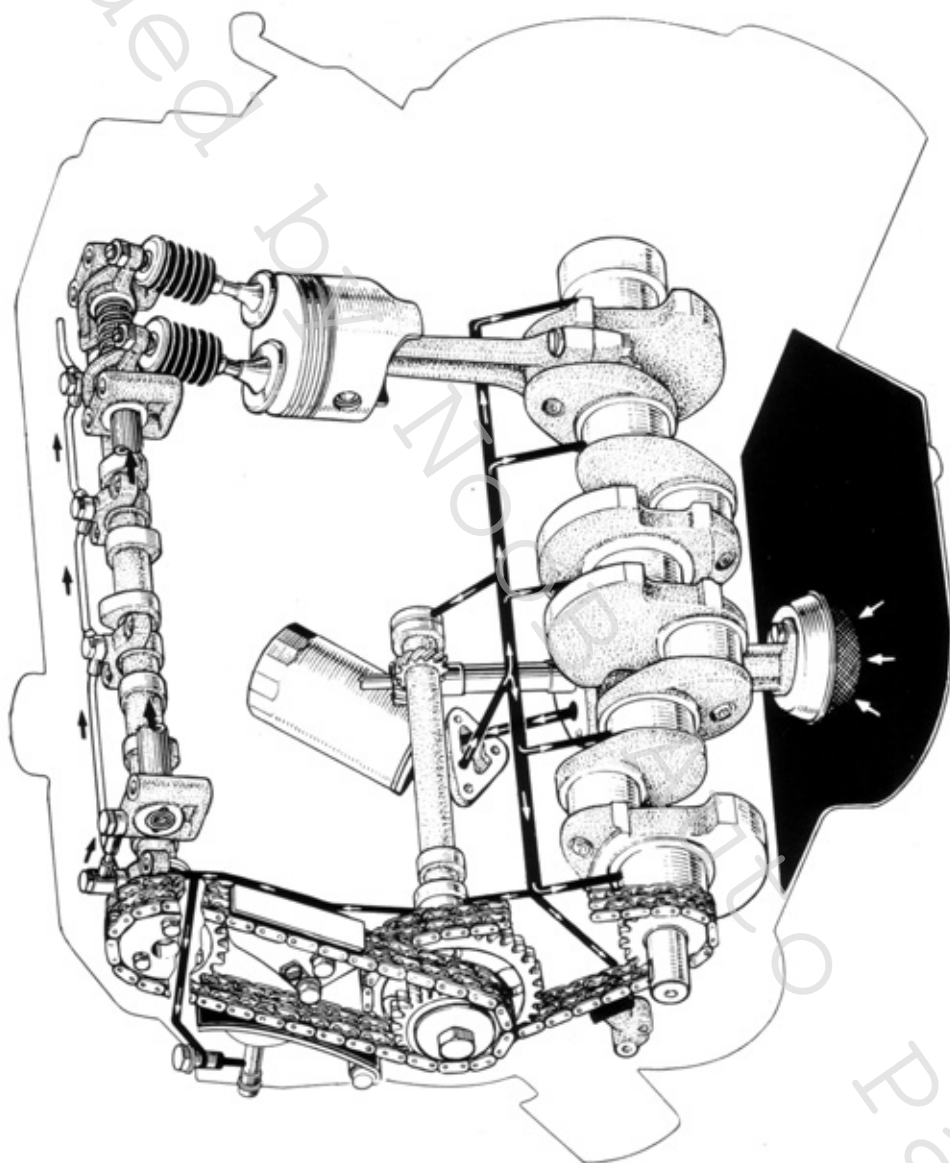
LUBRICATING SYSTEM

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LUBRICATING SYSTEM CIRCUIT

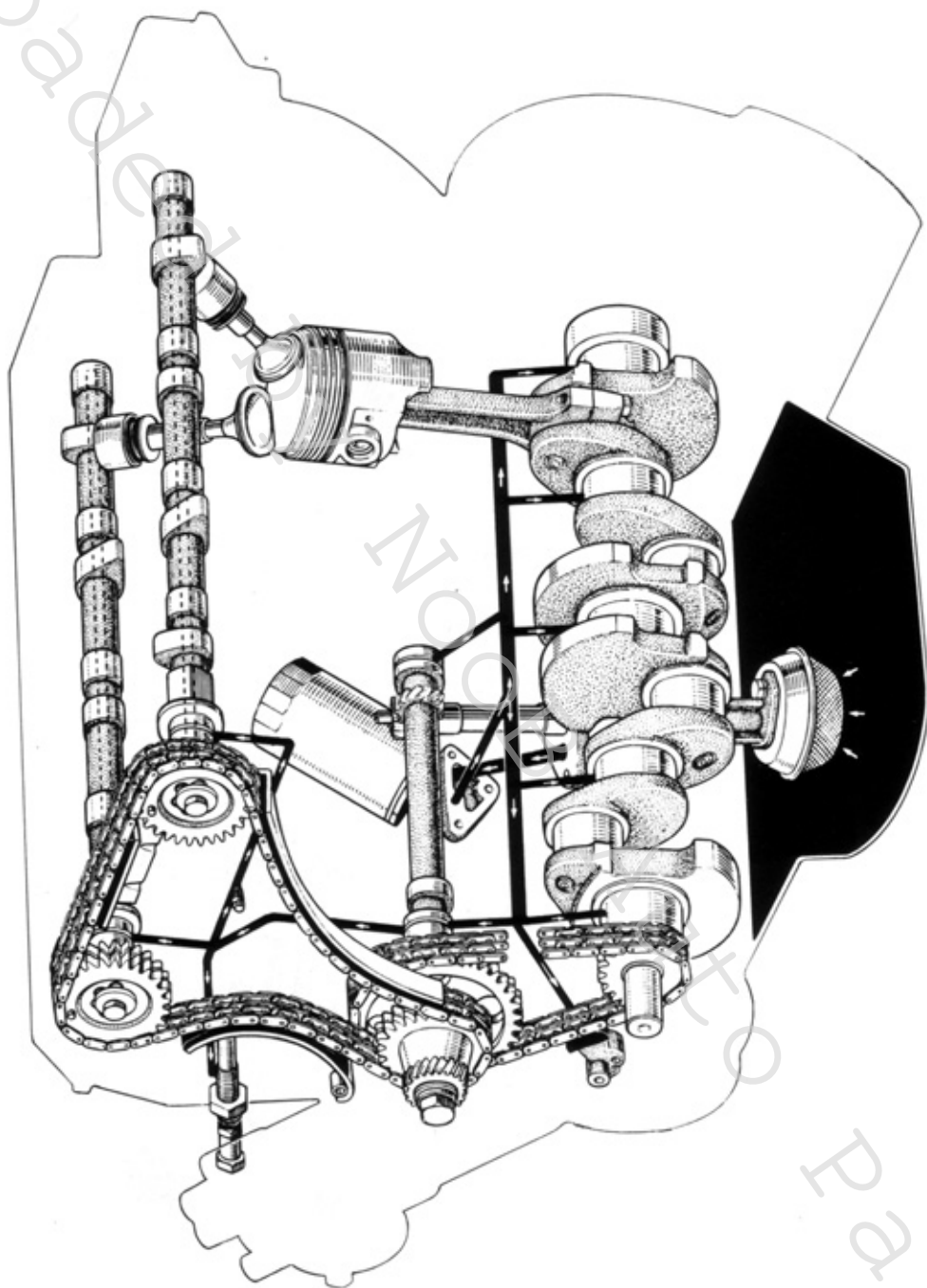
16R, 18R ENGINE

Fig. 6-1



18R-G ENGINE

Fig. 6-2

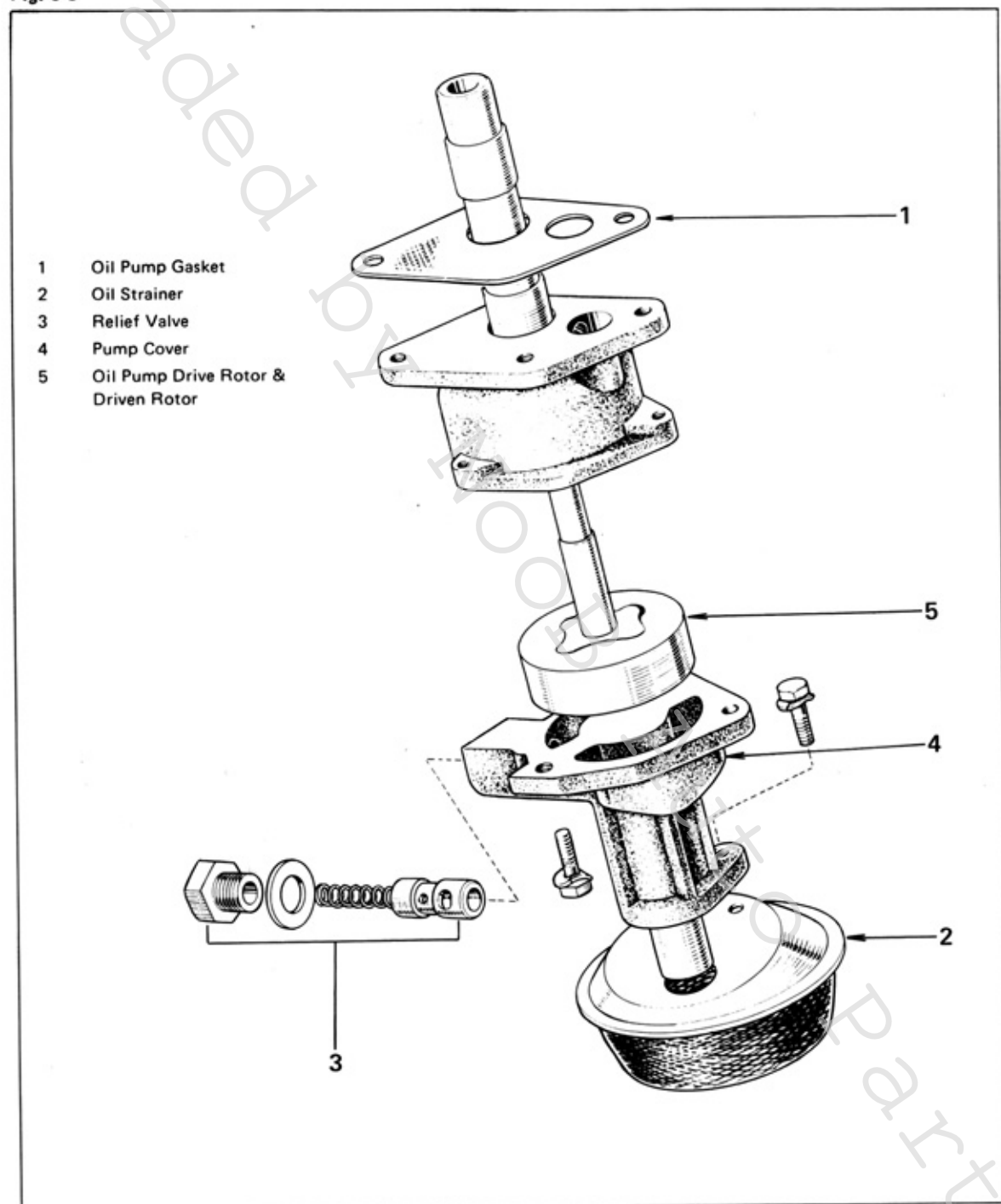


OIL PUMP

DISASSEMBLY (FOR 16R, 18R ENGINE)

Disassemble in numerical order.

Fig. 6-3



DISASSEMBLY (FOR 18R-G ENGINE)

Disassemble in numerical order.

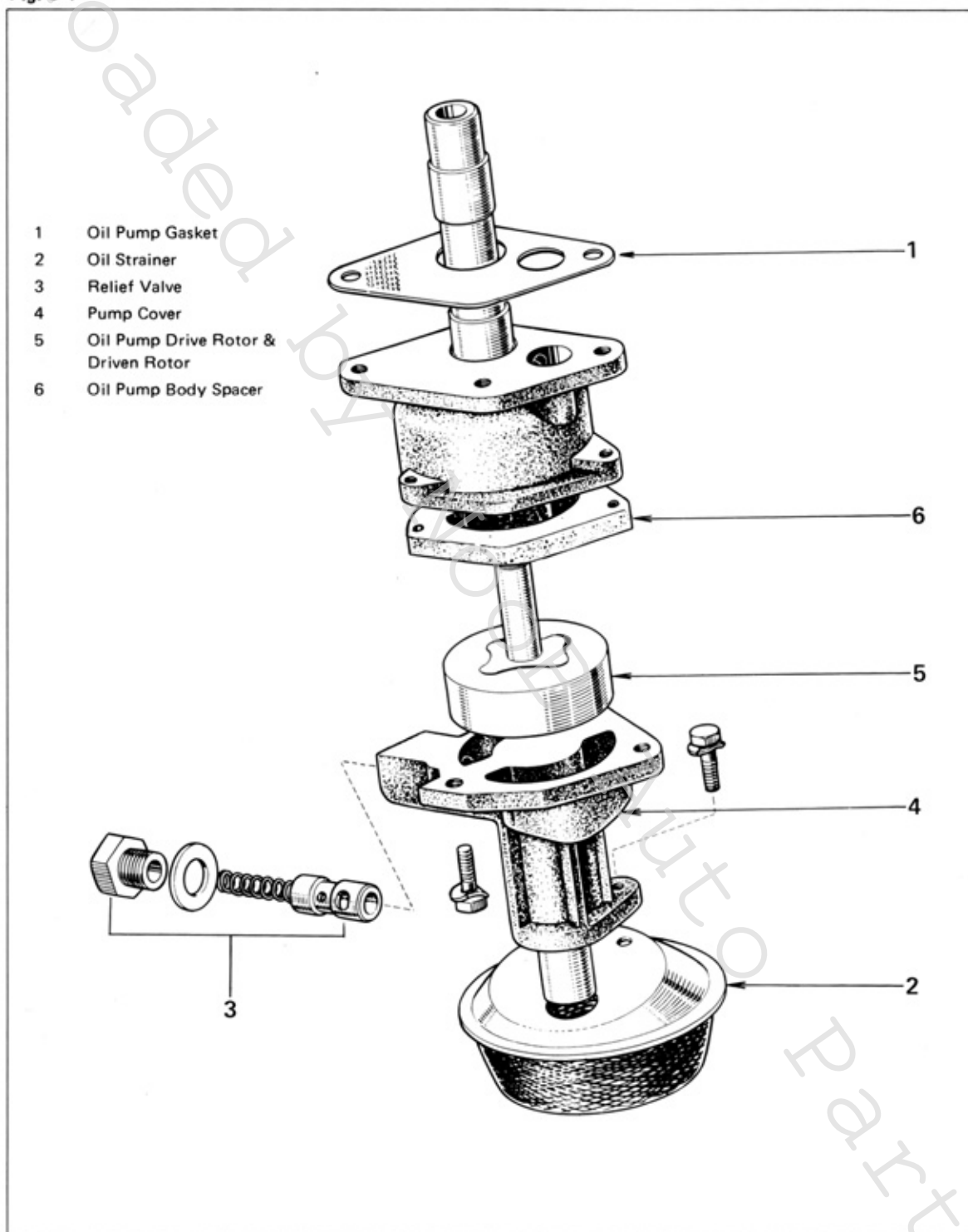
Fig. 6-4

Fig. 6-5

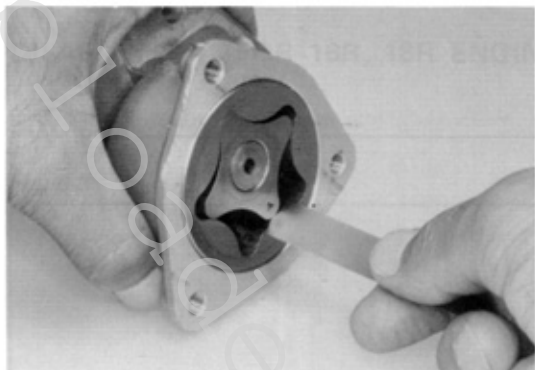


Fig. 6-6

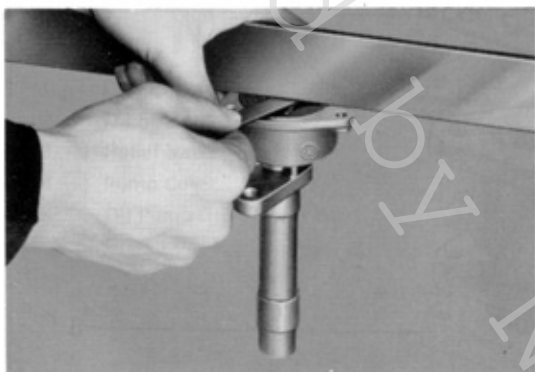


Fig. 6-7

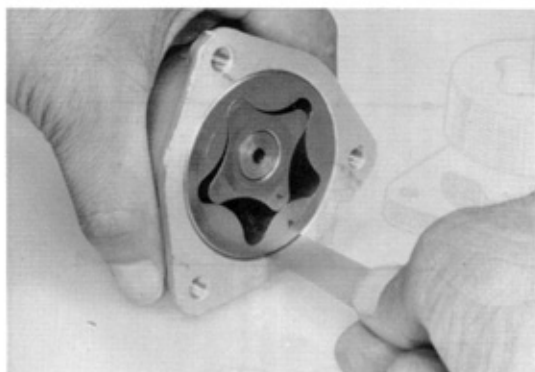
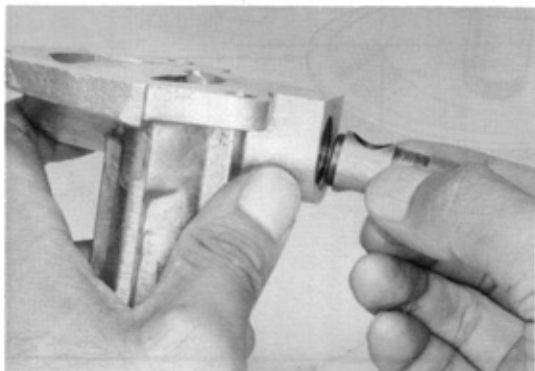


Fig. 6-8



INSPECTION



1. Measure the tip clearance. If it exceeds limit, replace the oil pump drive rotor set.

Limit**0.2 mm (0.008 in)****Standard****0.10–0.15 mm (0.0039–0.0059 in)**

2. Measure the side clearance (between rotor and cover). If it exceeds limit, replace either rotor or pump body.

Limit**0.15 mm (0.0059 in)****Standard****0.03–0.07 mm (0.0012–0.0028 in)**

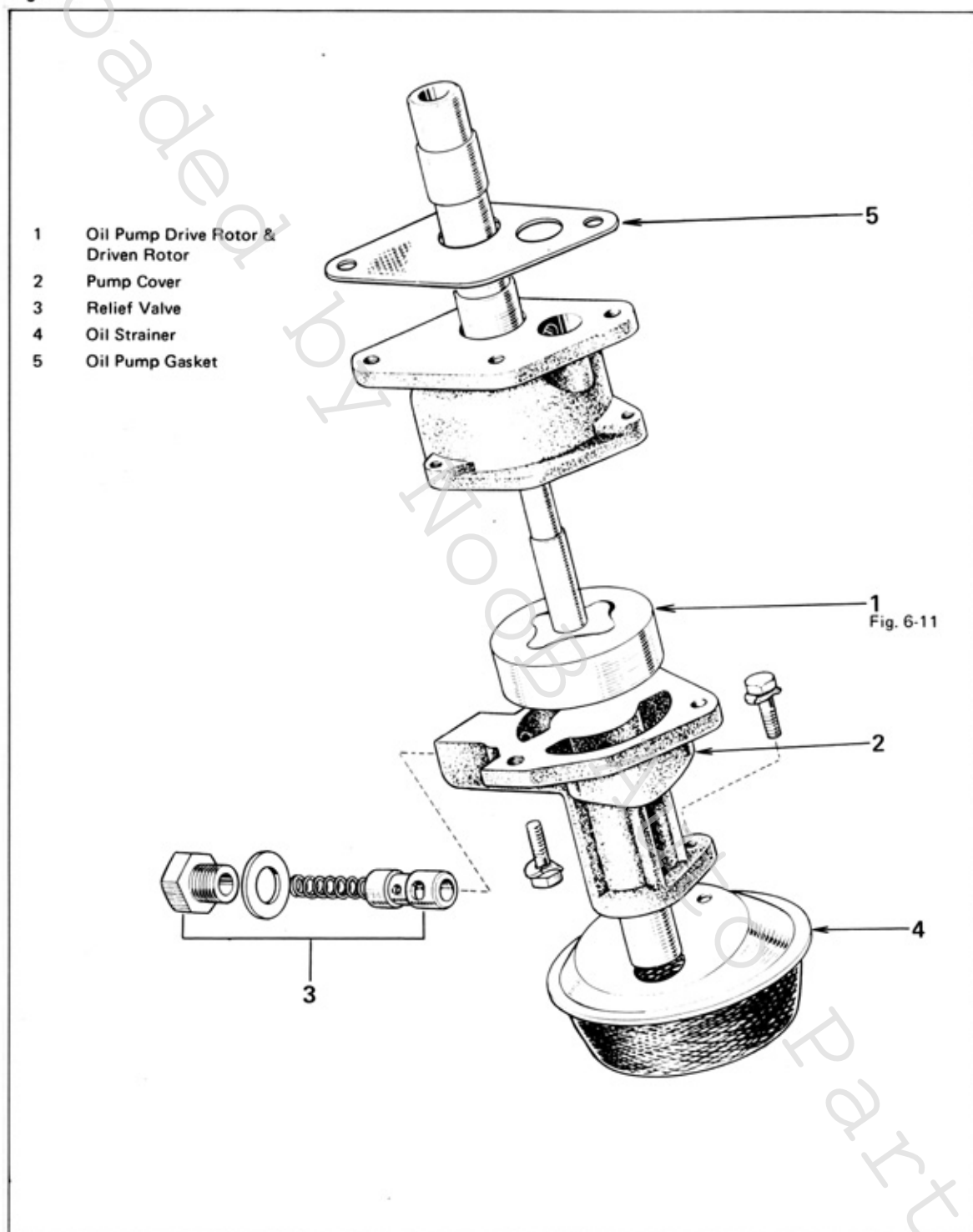
3. Measure the body clearance (between driven rotor and pump body). If it exceeds limit, replace either rotor or pump body.

Limit**0.2 mm (0.008 in)****Standard****0.10–0.16 mm (0.0039–0.0063 in)**

4. Inspect relief valve for scoring and wear. If damaged, replace valve or pump assembly.

ASSEMBLY (FOR 16R, 18R ENGINE)

Assemble in numerical order.

Fig. 6-9

ASSEMBLY (FOR 18R-G ENGINE)

Assemble in numerical order.

Fig. 6-10

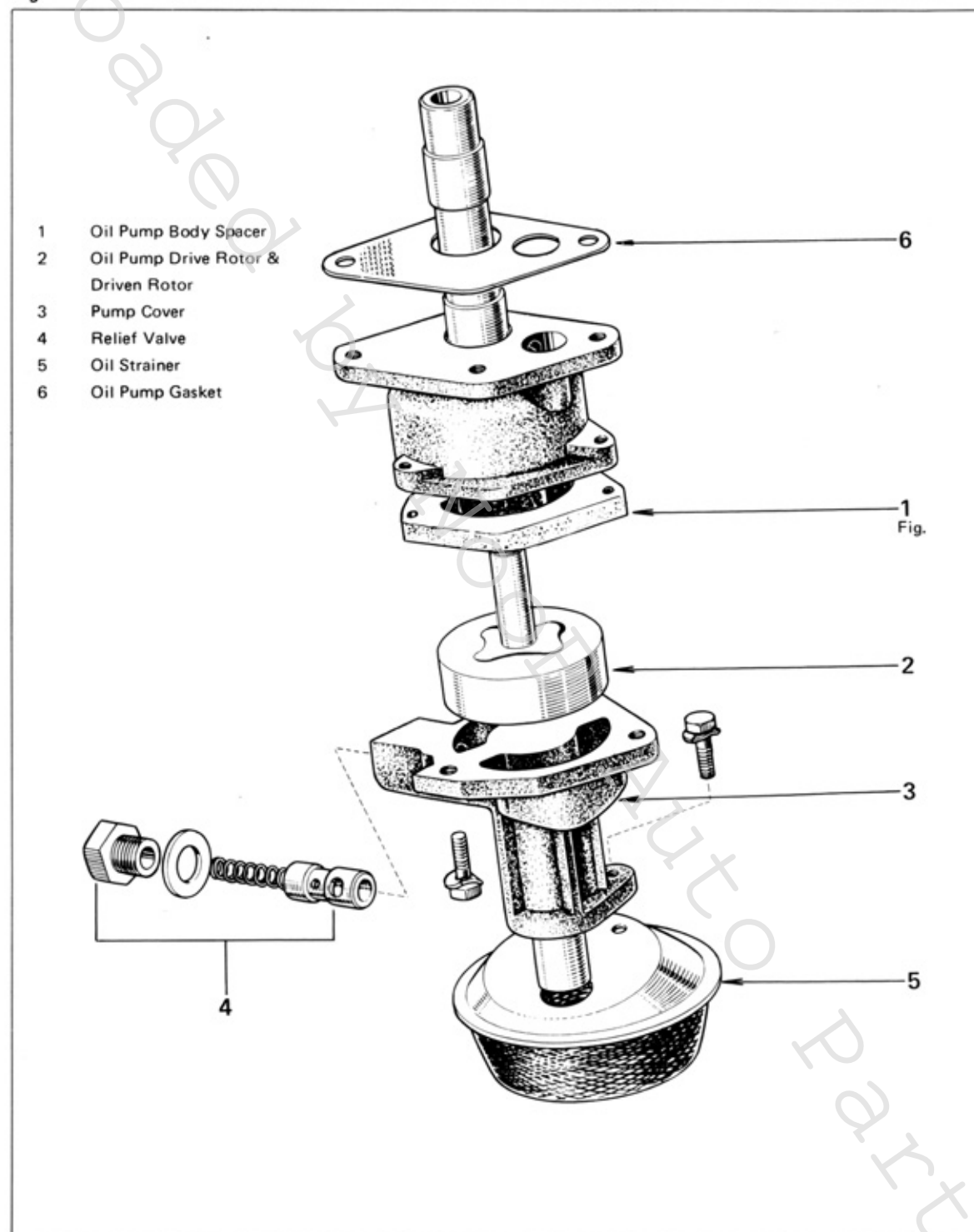
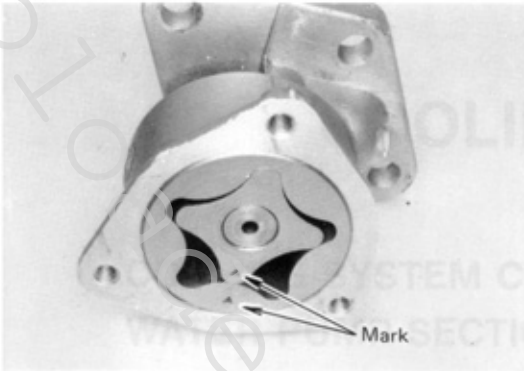


Fig. 6-11



Assemble the rotors so that the punch marks will be facing the pump cover.

Fig. 6-12



Check pump operation

Immerse the pump suction end into fresh engine oil, and turn the shaft clockwise with a screwdriver.

This should cause the oil to come out of discharge hole.

Close the discharge hole with thumb, and turn the shaft as before. Make sure that the shaft becomes heavy.

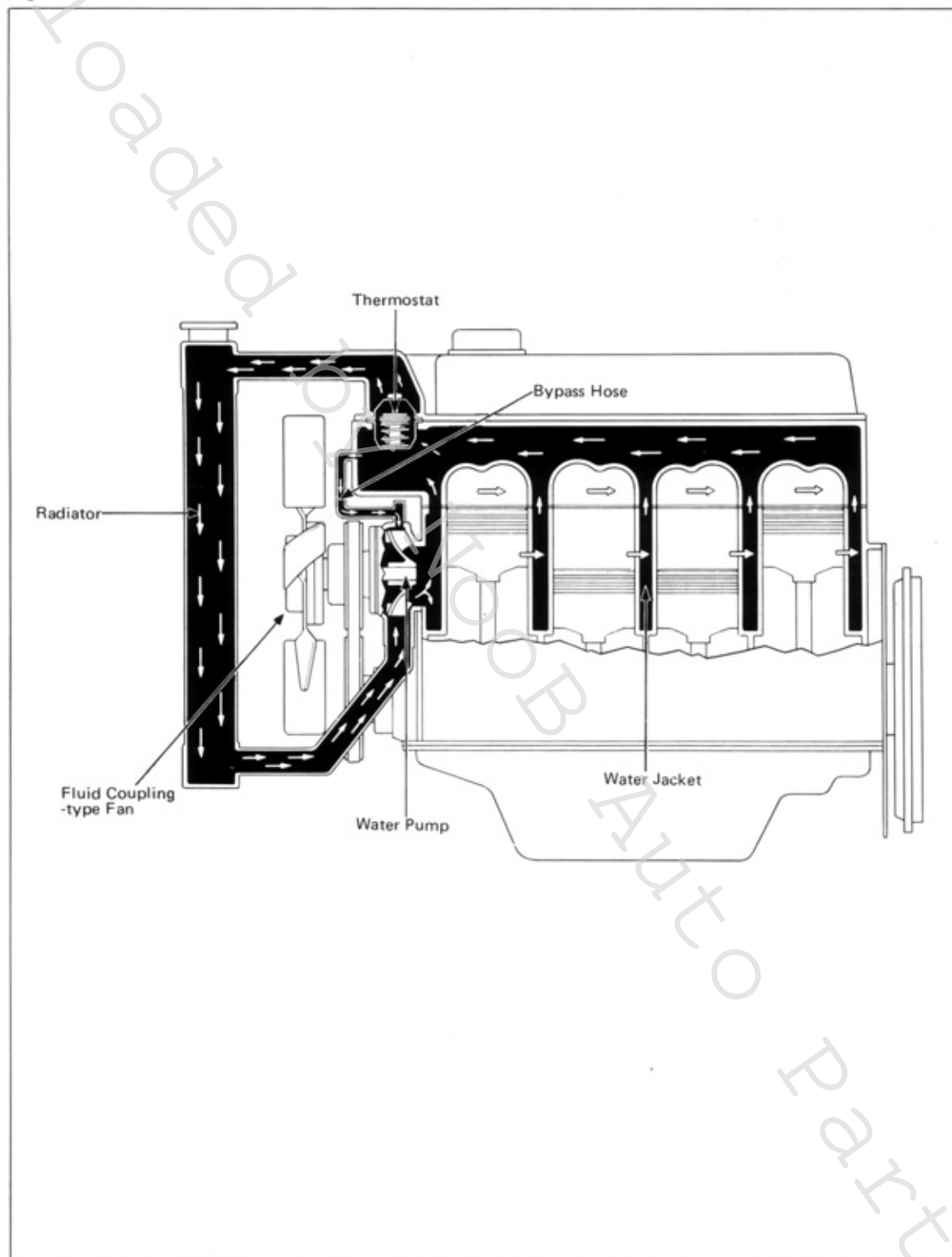
UpLoaded by Noob Auto Parts

COOLING SYSTEM

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| WATER PUMP (WITH TEMPERED COOLING FAN) | |
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| INSPECTION | 7 - 10 |
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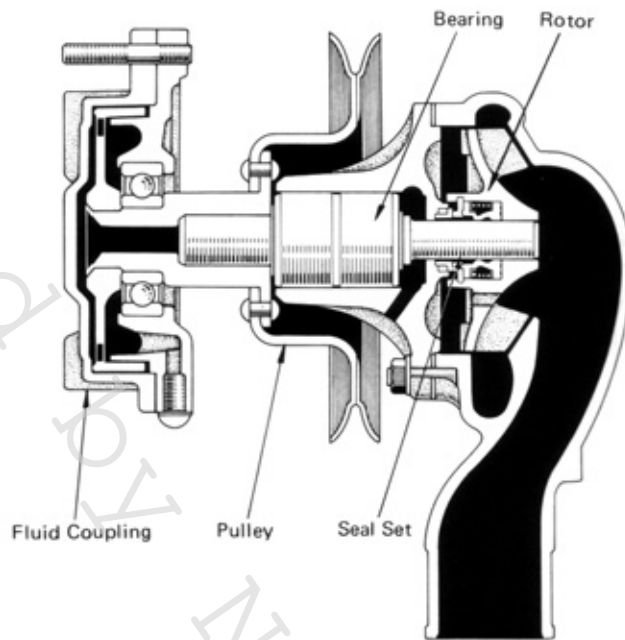
COOLING SYSTEM CIRCUIT

Fig. 7-1

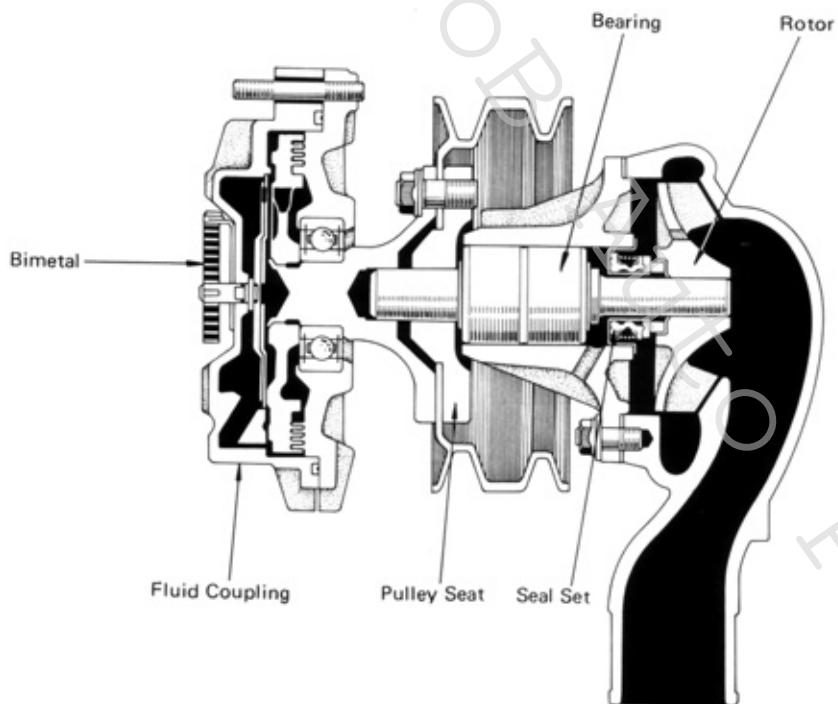


WATER PUMP SECTIONAL VIEW

Fig. 7-2



WITHOUT TEMPERED COOLING FAN



WITH TEMPERED COOLING FAN

WATER PUMP(WITHOUT TEMPERED COOLING FAN) DISASSEMBLY

Disassemble in numerical order.

Fig. 7-3

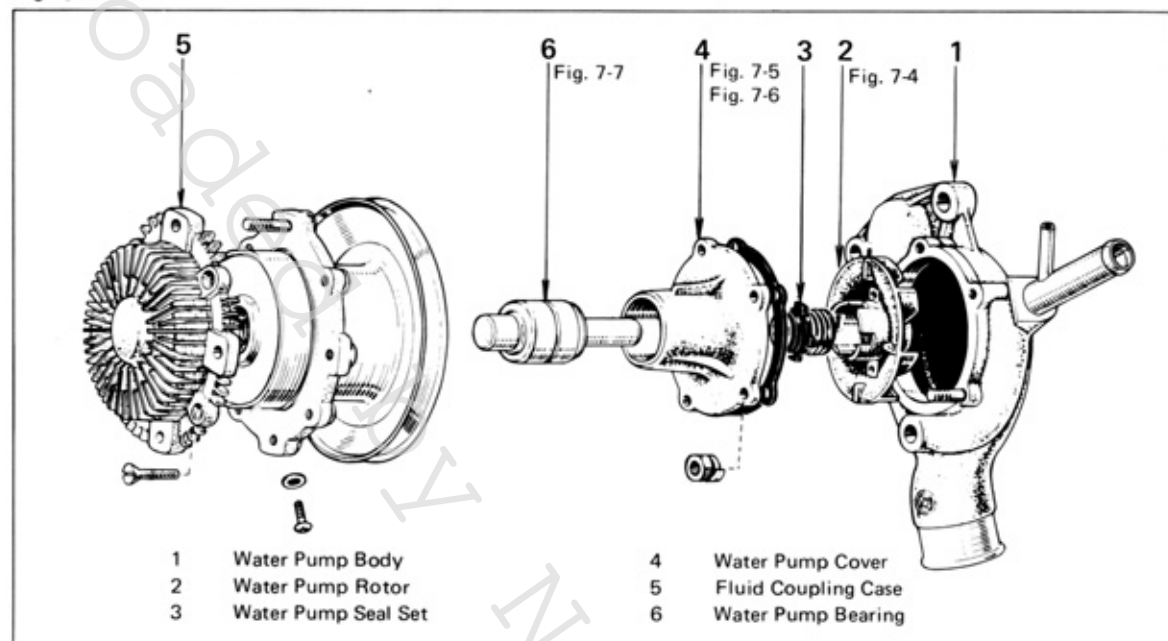
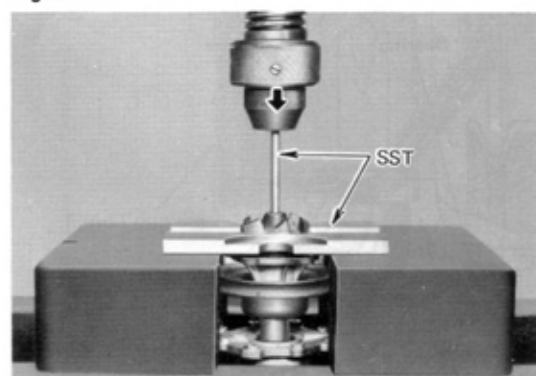
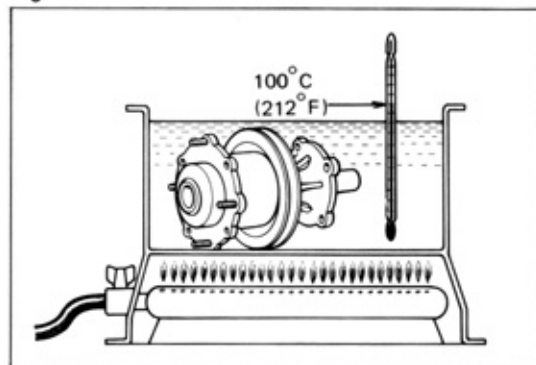


Fig. 7-4



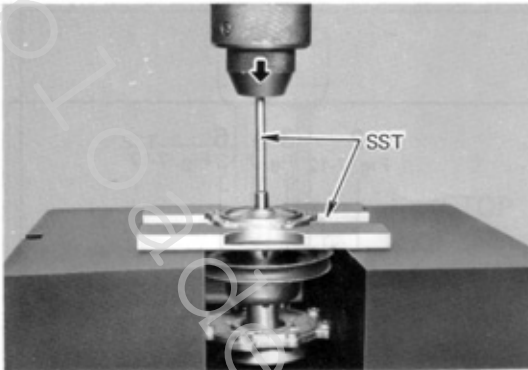
Using SST [09236-36010] and press, remove the rotor.

Fig. 7-5



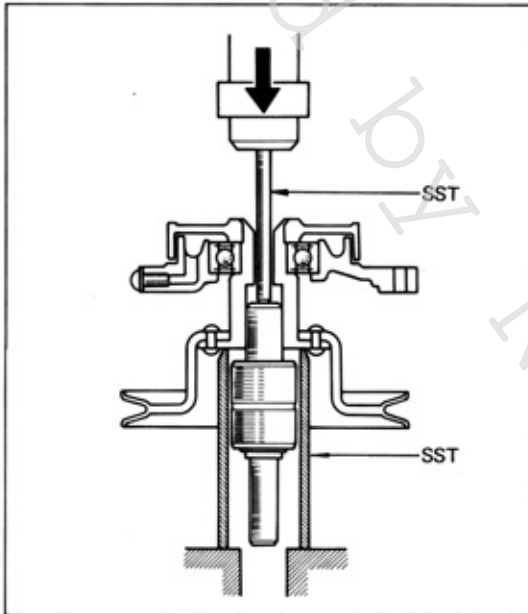
Heat the water pump cover to about 100°C (212°F).

Fig. 7-6



Using SST [09236-36010] and press, force out the bearing from cover.

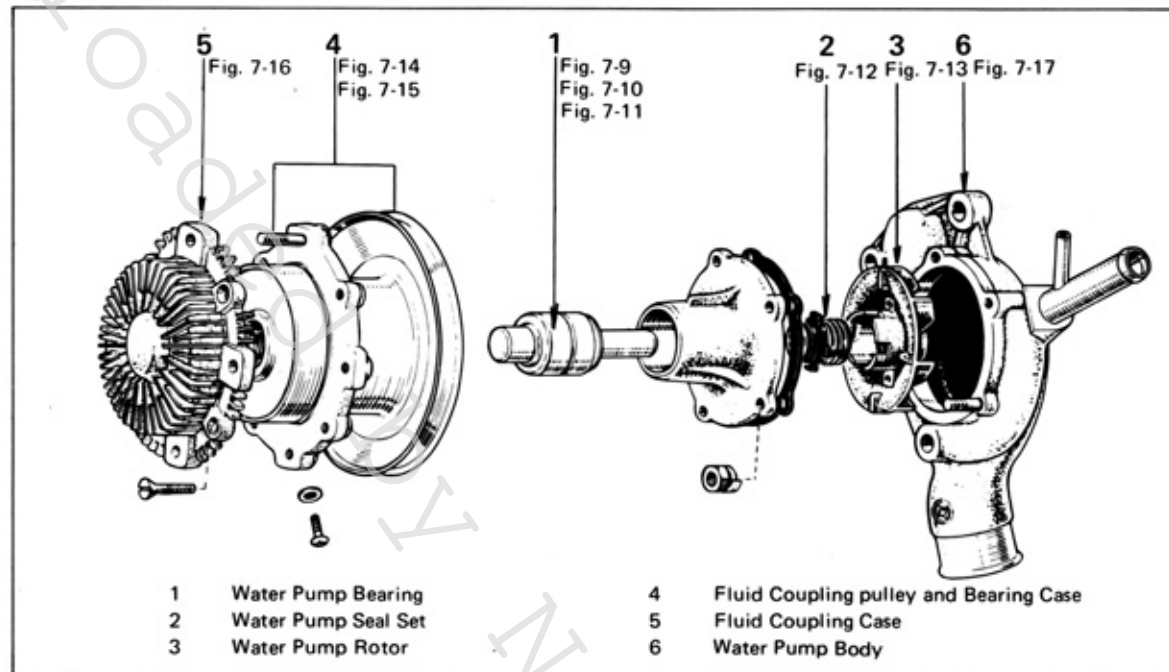
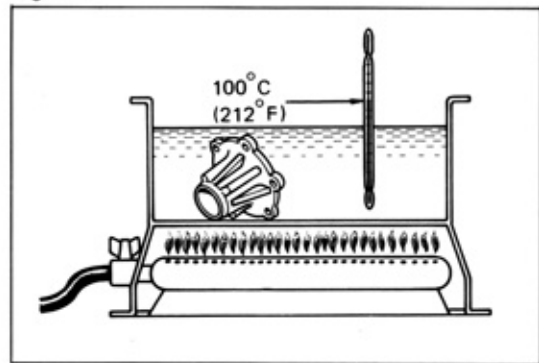
Fig. 7-7



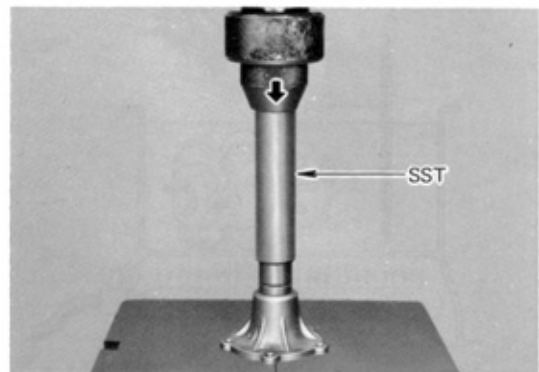
Using SST [09236-36010] and press, force out the bearing from fluid coupling.

ASSEMBLY

Assemble in numerical order.

Fig. 7-8**Fig. 7-9**

Heat the cover to about 100°C (212°F).

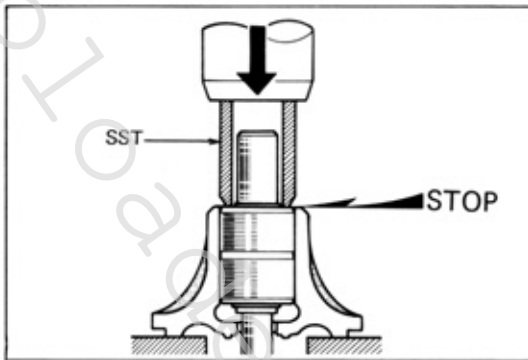
Fig. 7-10

Using SST [09236-36010], press the bearing into the cover.

— caution —

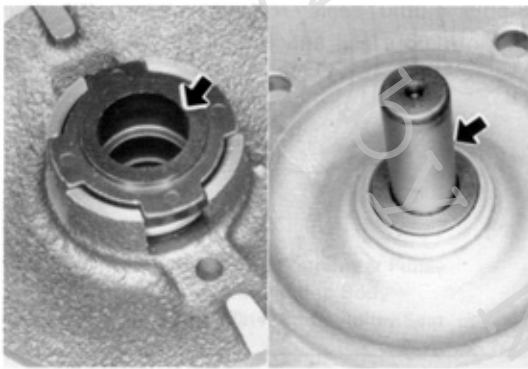
Never press on the bearing shaft.

Fig. 7-11



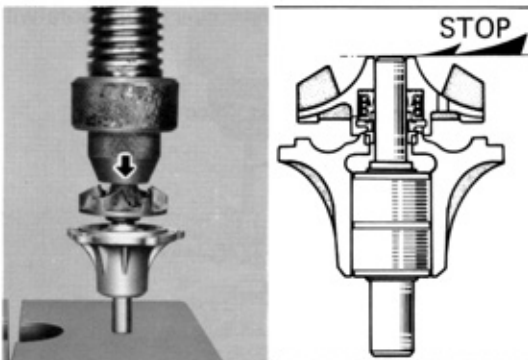
Press in until the bearing end surface is flush with the cover upper surface.

Fig. 7-12



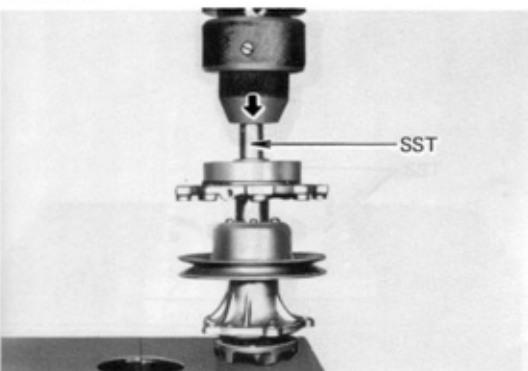
Apply a small amount of silicon oil on contacting surface between the floating seat and the thrust washer, and assemble the seal set.

Fig. 7-13



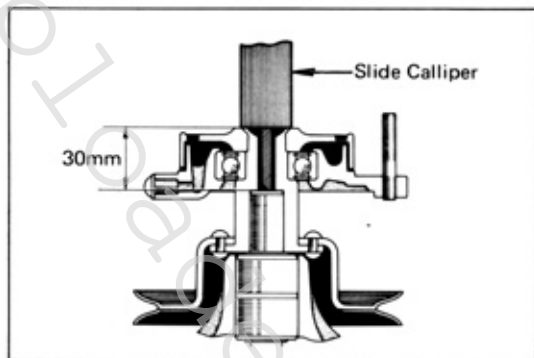
Press the rotor into the bearing shaft, and align the shaft and rotor at top end surface.

Fig. 7-14



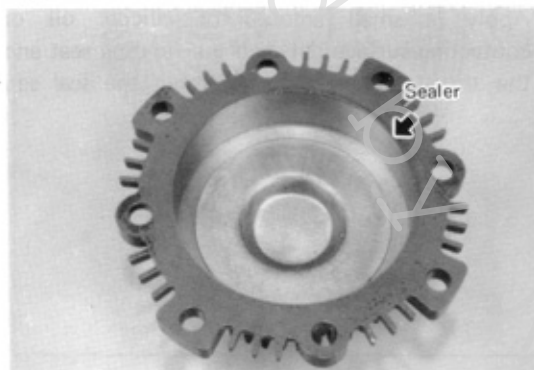
Using SST [09236-36010] and press, install the fluid coupling onto the bearing shaft.

Fig. 7-15



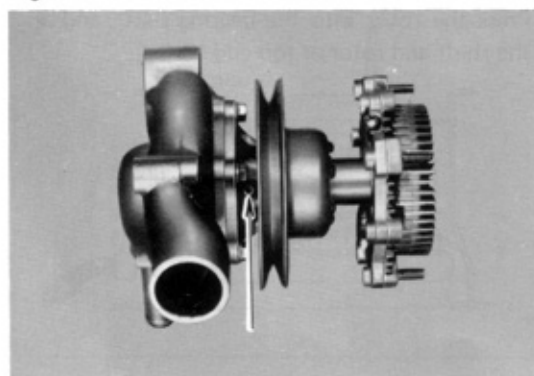
Install the fluid coupling as shown.

Fig. 7-16



Apply liquid sealer on the coupling case mounting surface and install the coupling case.

Fig. 7-17



Install so that the pump cover drain hole will be positioned downward.

Applicable Fluid
Silicon oil 6,000 cst. 25cc

WATER PUMP(WITH TEMPERED COOLING FAN) DISASSEMBLY

Disassemble in numerical order.

Fig. 7-18

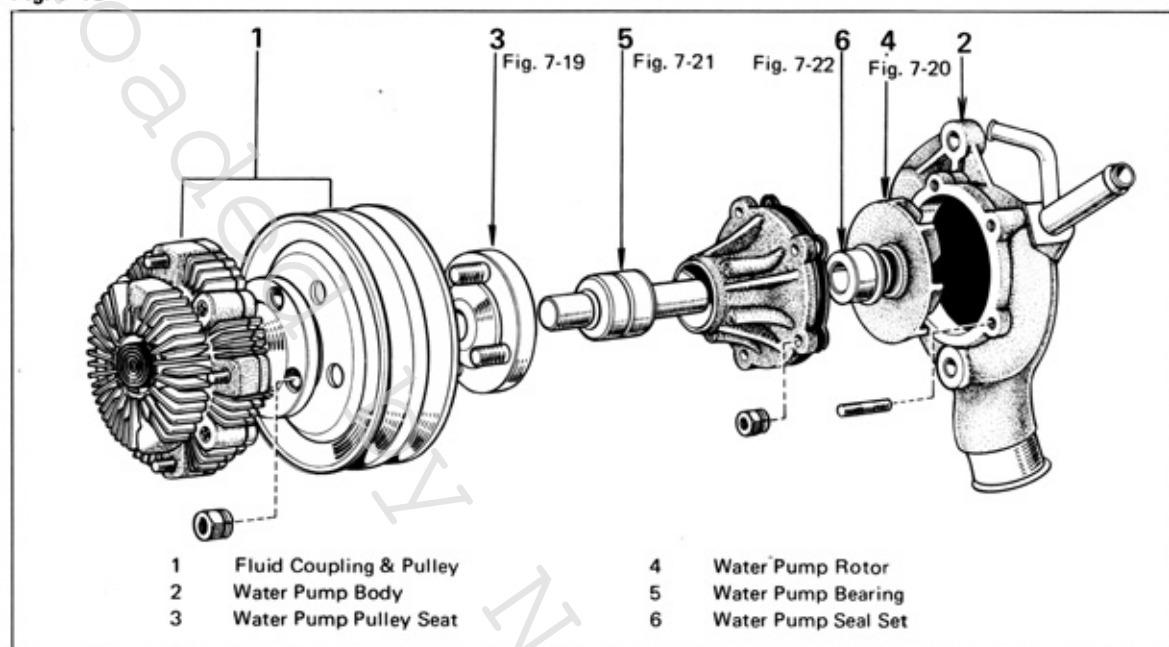
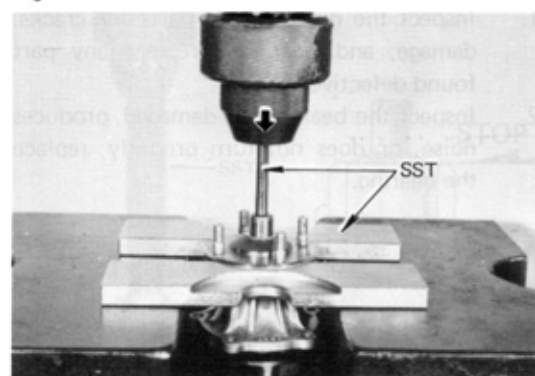
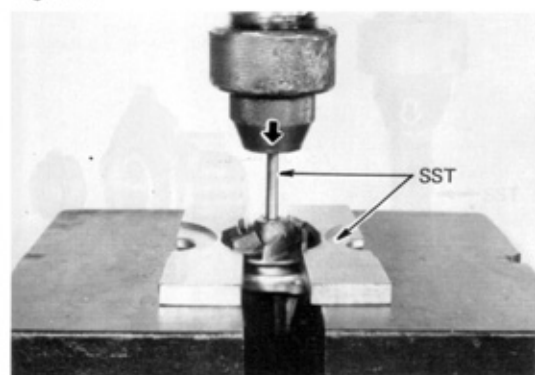


Fig. 7-19



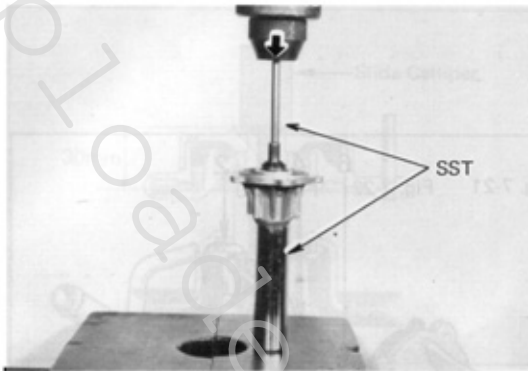
Using SST [09236-36010] and a press, force out the bearing shaft from the pulley seat.

Fig. 7-20



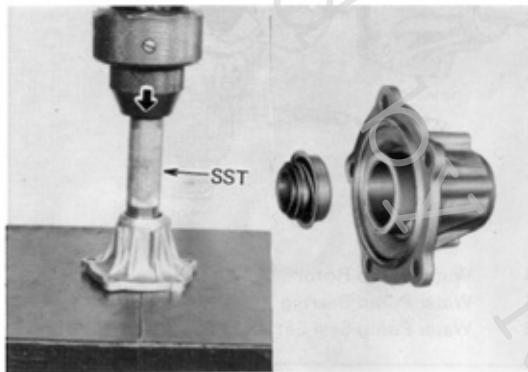
Using SST [09236-36010] and a press, force out the bearing shaft from the rotor.

Fig. 7-21



Heat the water pump cover to about 100°C (212°F), and using SST [09236-36010] and a press, force out the bearing from the pump cover.

Fig. 7-22

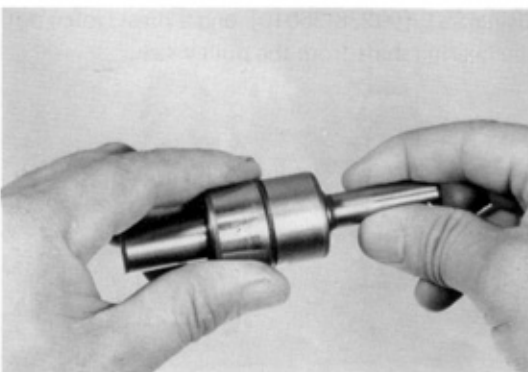


Using a press, force out the seal set from the pump cover.

— Note —

Force out from the pulley end.

Fig. 7-23



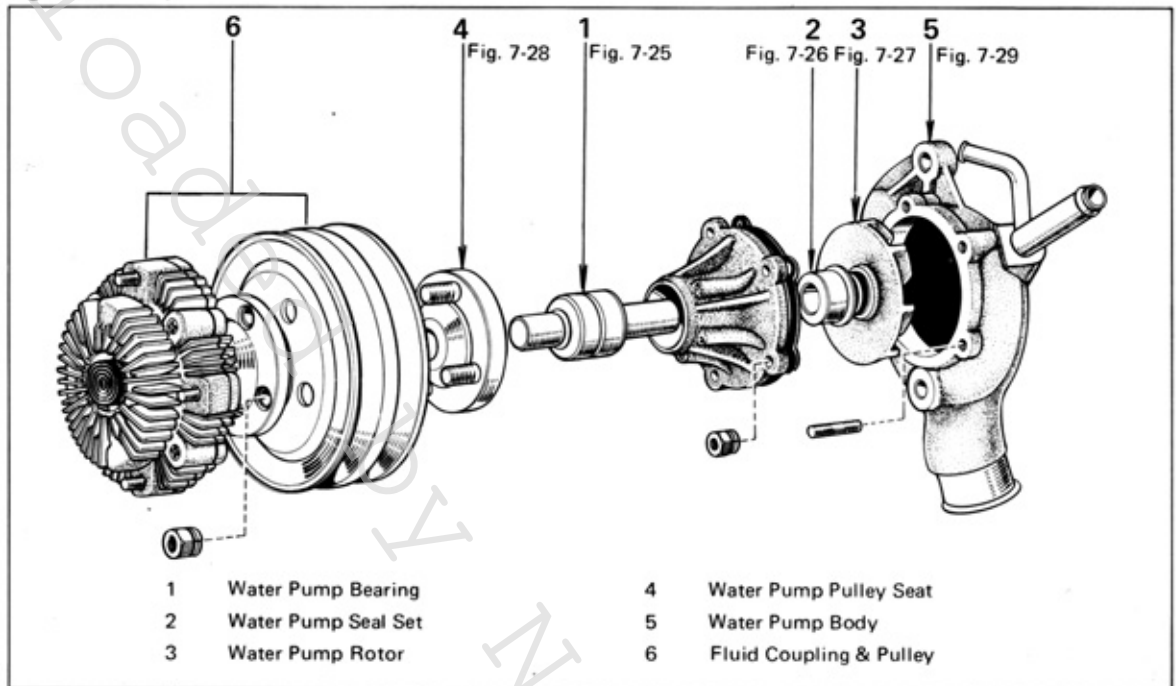
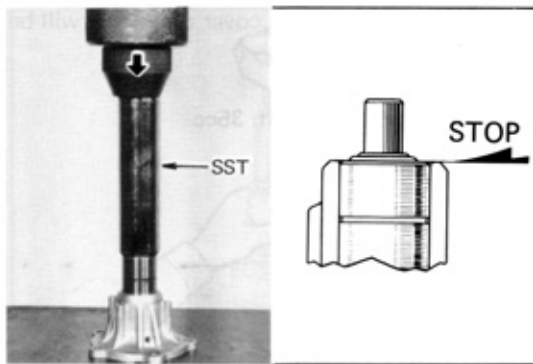
INSPECTION



1. Inspect the disassembled parts for cracks, damage, and wear, and replace any part found defective.
2. Inspect the bearing. If damaged, produces noise, or does not turn properly, replace the bearing.

ASSEMBLY

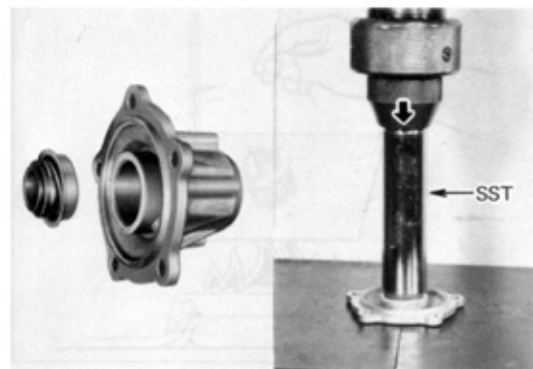
Assemble in numerical order.

Fig. 7-24**Fig. 7-25**

Heat the pump cover to about 100°C (212°F) and force in the bearing with SST [09236-36010] and press.

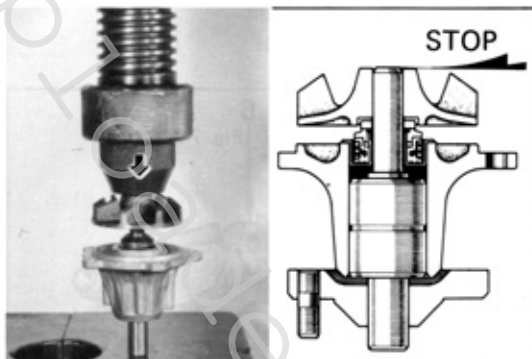
— Note —

Press in the bearing until its end surface is flush with cover surface.

Fig. 7-26

Apply liquid sealer on the seal set, and press the seal set into the pump cover.

Fig. 7-27

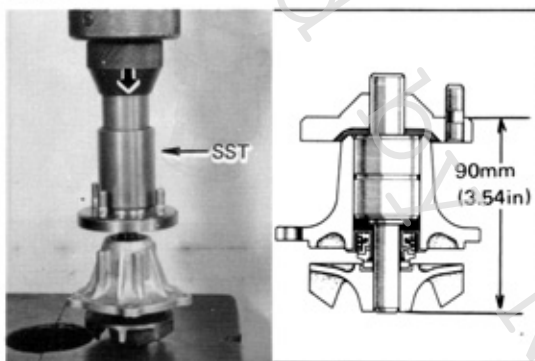


Using a press, force in rotor.

— Note —

Press in the rotor until it is flush with the shaft end.

Fig. 7-28

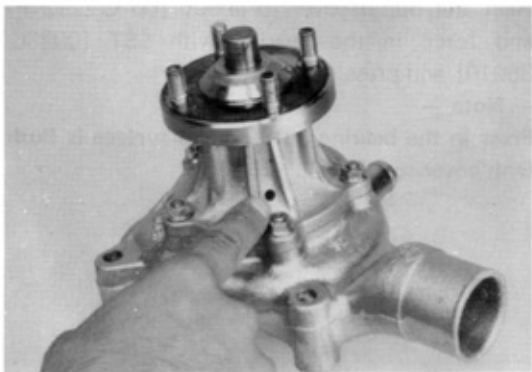


Using a press and SST [09238-40010], force in the pulley seat.

— Note —

Press in the pulley seat until the distance from the bearing shaft end surface to the pulley seat end surface is 90 mm (3.54 in) as shown.

Fig. 7-29



Install so that the pump cover drain hole will be positioned downward.

Applicable Fluid

Silicon oil 3,000 cst. 35cc

Fig. 7-30

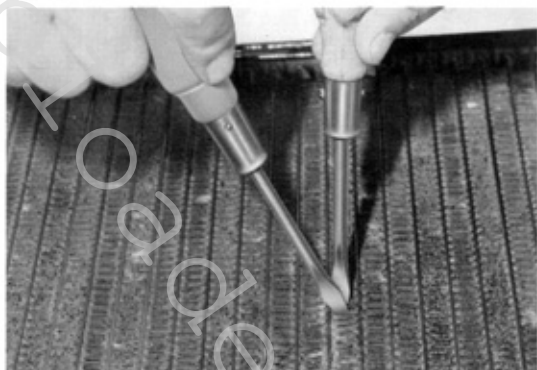


Fig. 7-31

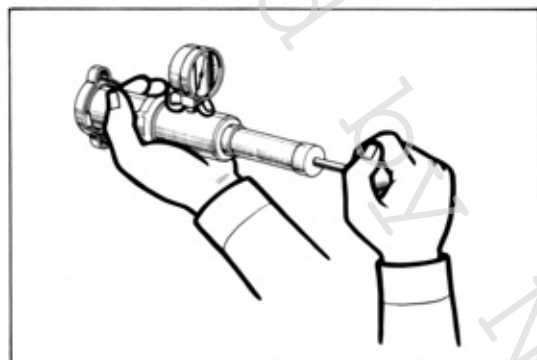


Fig. 7-32

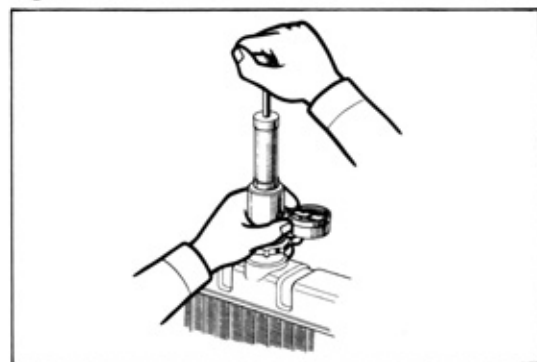
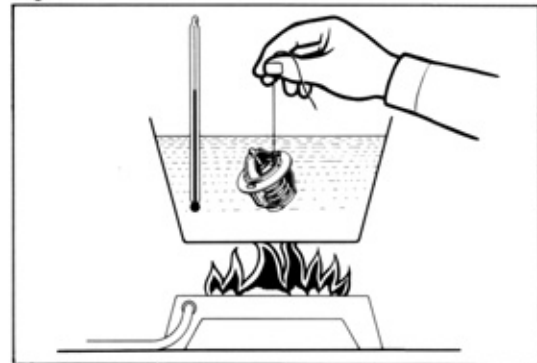


Fig. 7-33



RADIATOR

INSPECTION & REPAIR



1. Inspect the radiator core fins, and repair any fins blocking air passage by the method as shown.



2. Inspect the radiator cap regulation pressure and vacuum valves for spring tension and seating. If the pressure gauge drops rapidly and excessively, replace the radiator cap.

Valve opening pressure limit

0.6 kg/cm² (8.5 psi)

Standard 0.9 kg/cm² (12.8 psi)



3. Inspect the cooling system for leaks. Attach the pressure tester to the radiator and pump it to the specified pressure. If the pressure gauge drops, inspect all hoses and fittings for an external leak. If no external leak is found, an internal intake manifold, block or heater core leak should be suspected.

THERMOSTAT

INSPECTION



1. Replace if the valve remains open at normal temperature or does not have proper tightness when fully closed.
2. Immerse the thermostat in the water, and check the valve opening temperatures by heating the water gradually.
The valve is satisfactory if it starts to open at 80.5° to 83.5°C (177° to 182°F) and opens to more than 8 mm (0.32 in) at 95°C (203°F).
Replace if necessary.

UpLoaded by Noob Auto Parts

FUEL SYSTEM

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FUEL PUMP

DISASSEMBLY

Disassemble in numerical order.

Fig. 8-1

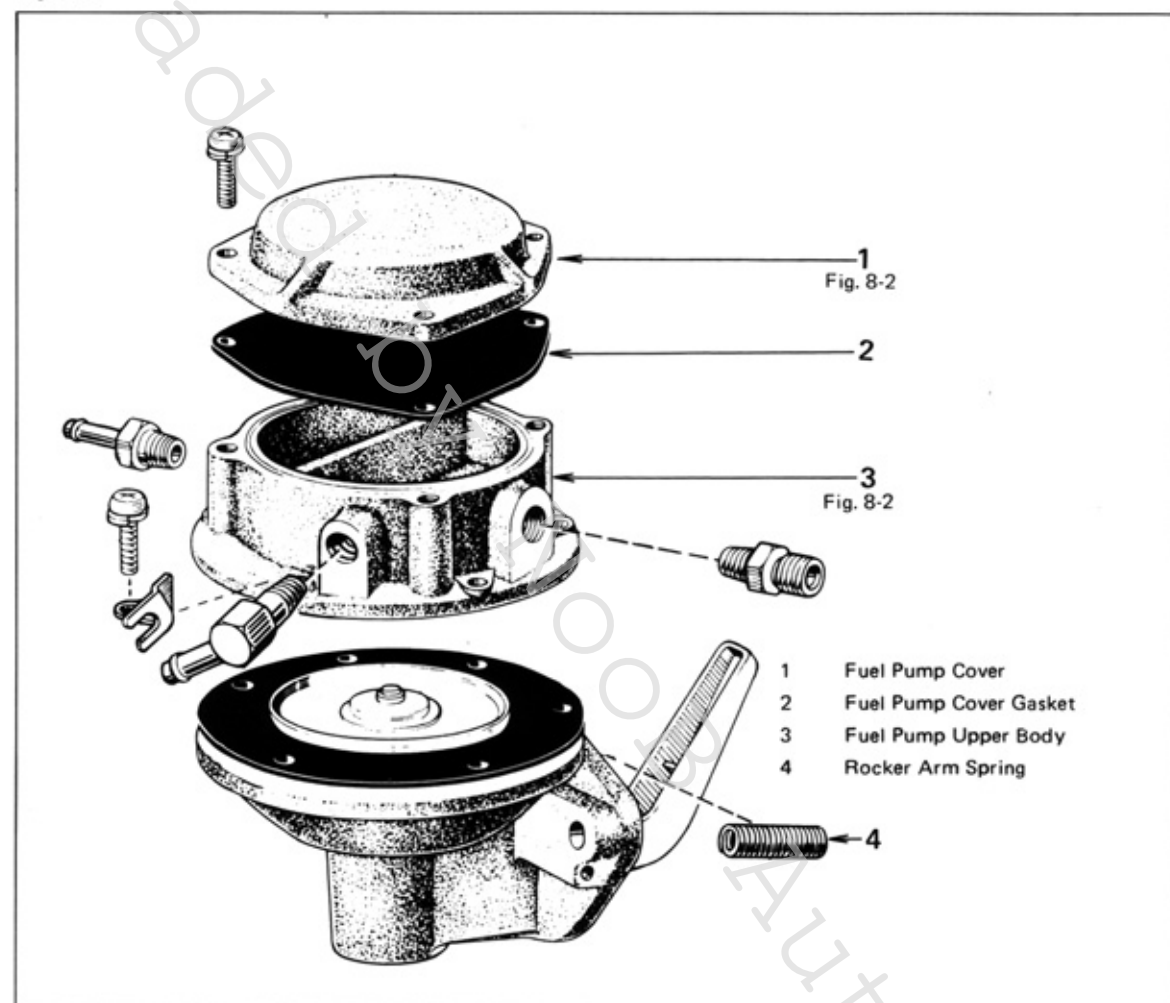
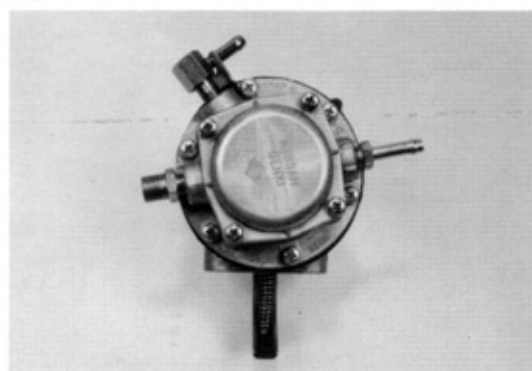
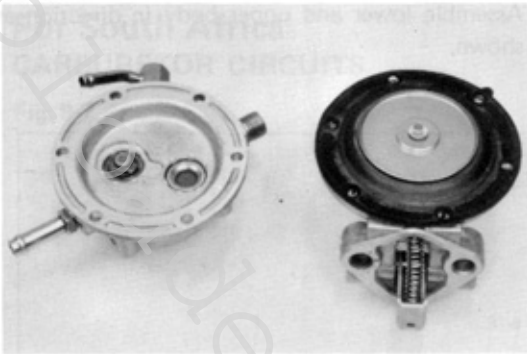


Fig. 8-2



Mark the position of pump cover and upper body.

Fig. 8-3



INSPECTION

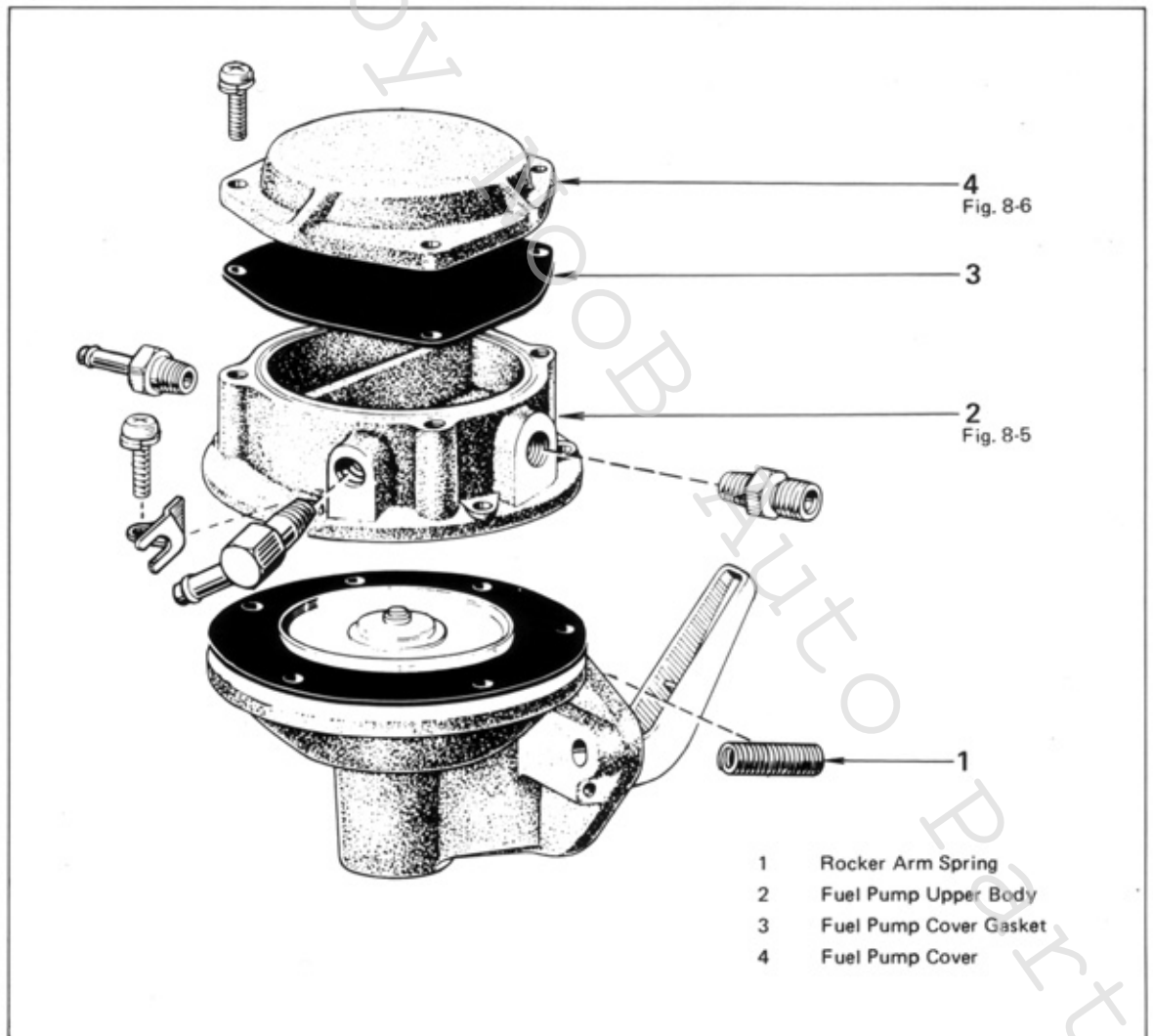
Inspect diaphragms for tear and check valves for defective operation. Replace if damaged.



ASSEMBLY

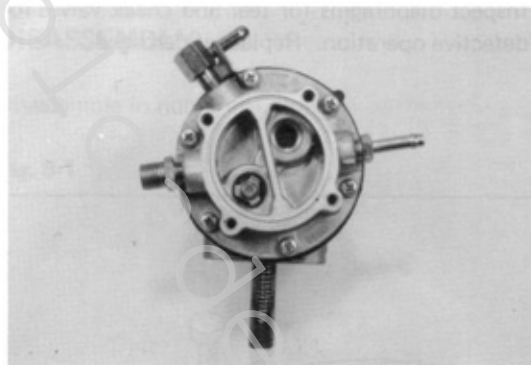
Assemble in numerical order.

Fig. 8-4



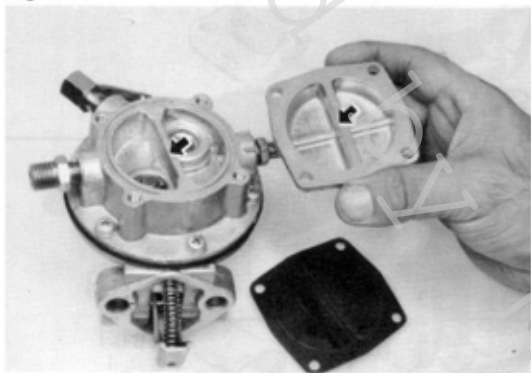
- 1 Rocker Arm Spring
- 2 Fuel Pump Upper Body
- 3 Fuel Pump Cover Gasket
- 4 Fuel Pump Cover

Fig. 8-5



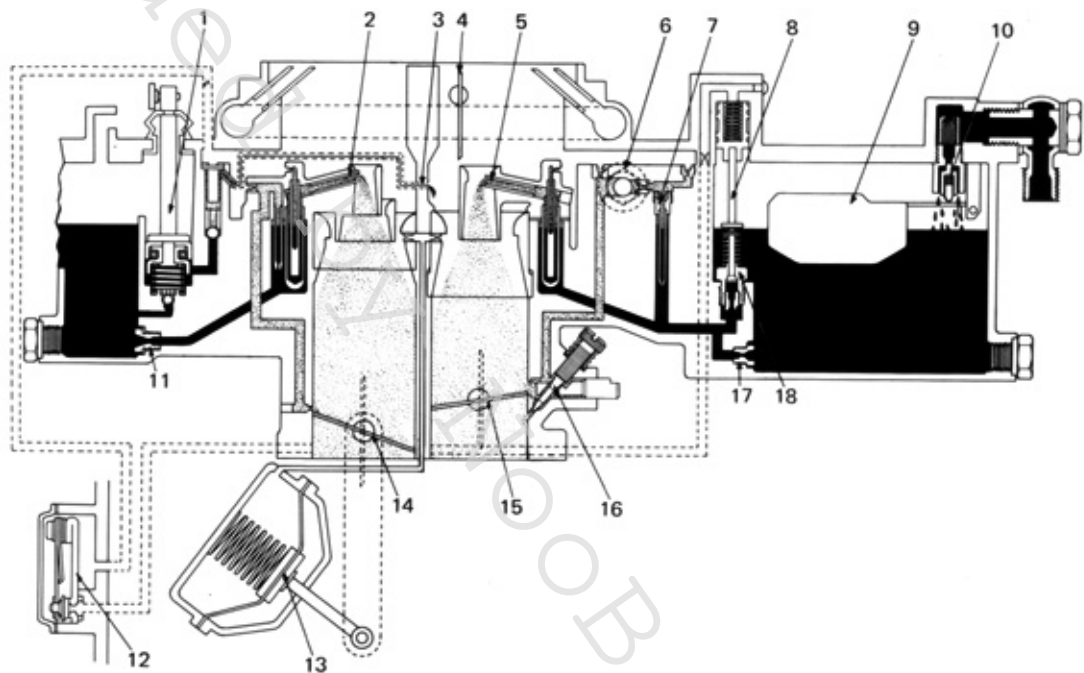
Assemble lower and upper body in direction as shown.

Fig. 8-6



Assemble upper body and cover over the diaphragm.

Inlet and outlet chamber separating walls should be aligned.

CARBURETOR(FOR 18R ENGINE)**For South Africa****CARBURETOR CIRCUITS****Fig. 8-7**

- 1 Pump Plunger
- 2 2nd Main Nozzle
- 3 Pump Jet
- 4 Choke Valve
- 5 1st Main Nozzle
- 6 Solenoid Valve
- 7 Slow Jet
- 8 Power Piston
- 9 Float

- 10 Needle Valve
- 11 2nd Main Jet
- 12 Thermostatic Valve
- 13 Diaphragm
- 14 2nd Throttle Valve
- 15 1st Throttle Valve
- 16 Idle Mixture Adjusting Screw
- 17 1st Main Jet
- 18 Power Valve

DISASSEMBLY

Air Horn

Disassemble in numerical order.

Fig. 8-8

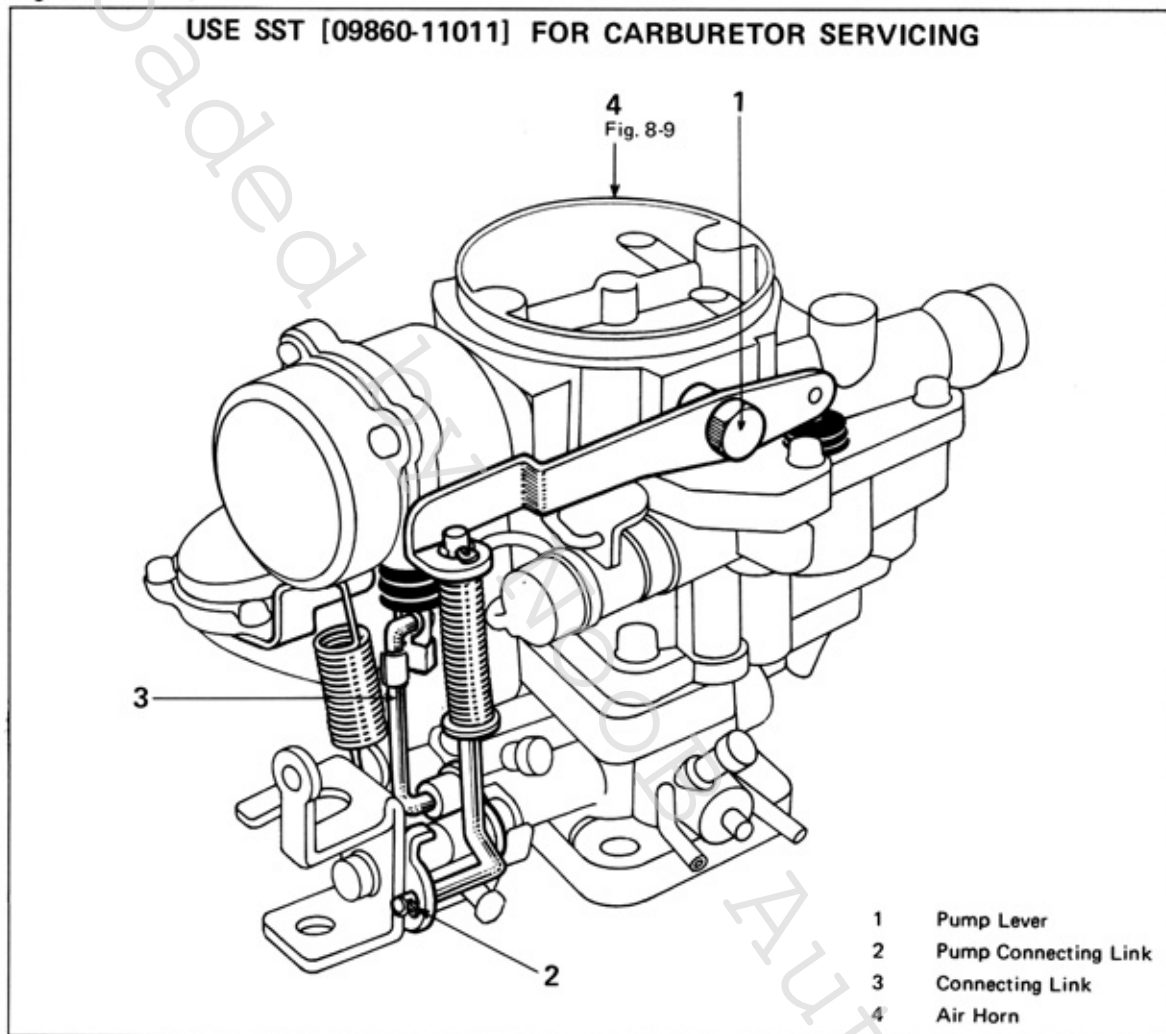
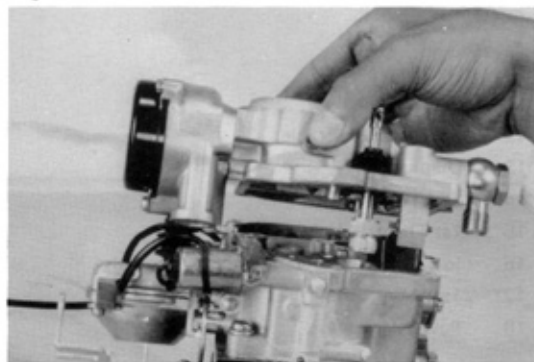


Fig. 8-9



Lift out air horn.

Disassemble in numerical order.

Fig. 8-10

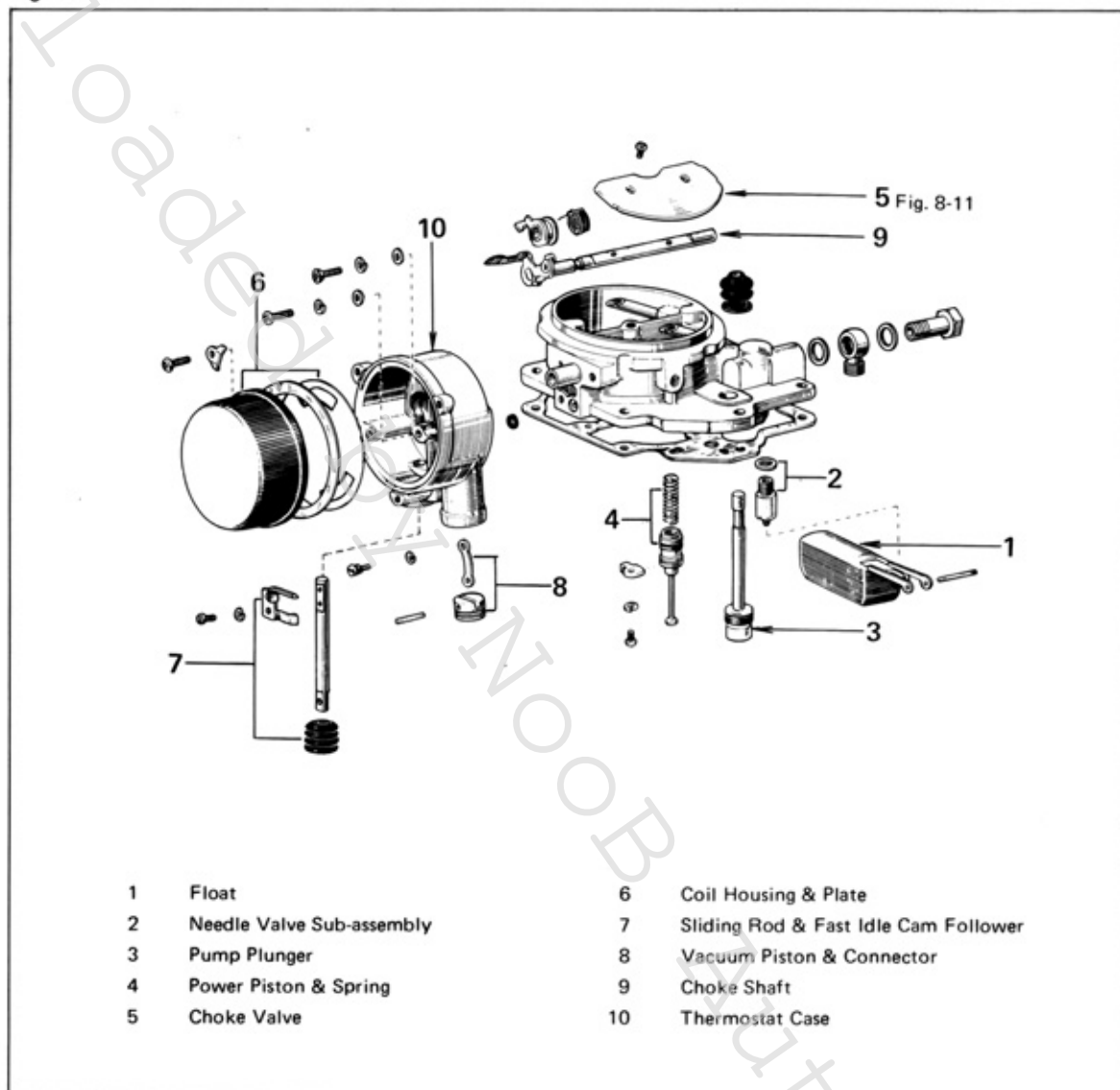
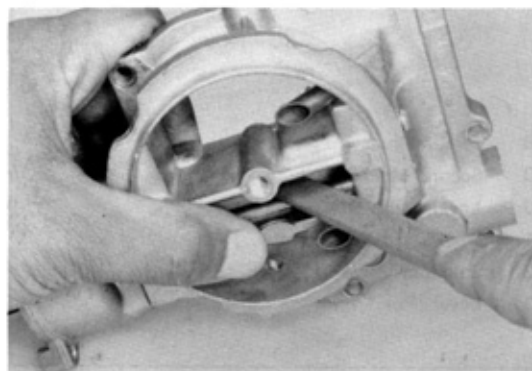


Fig. 8-11

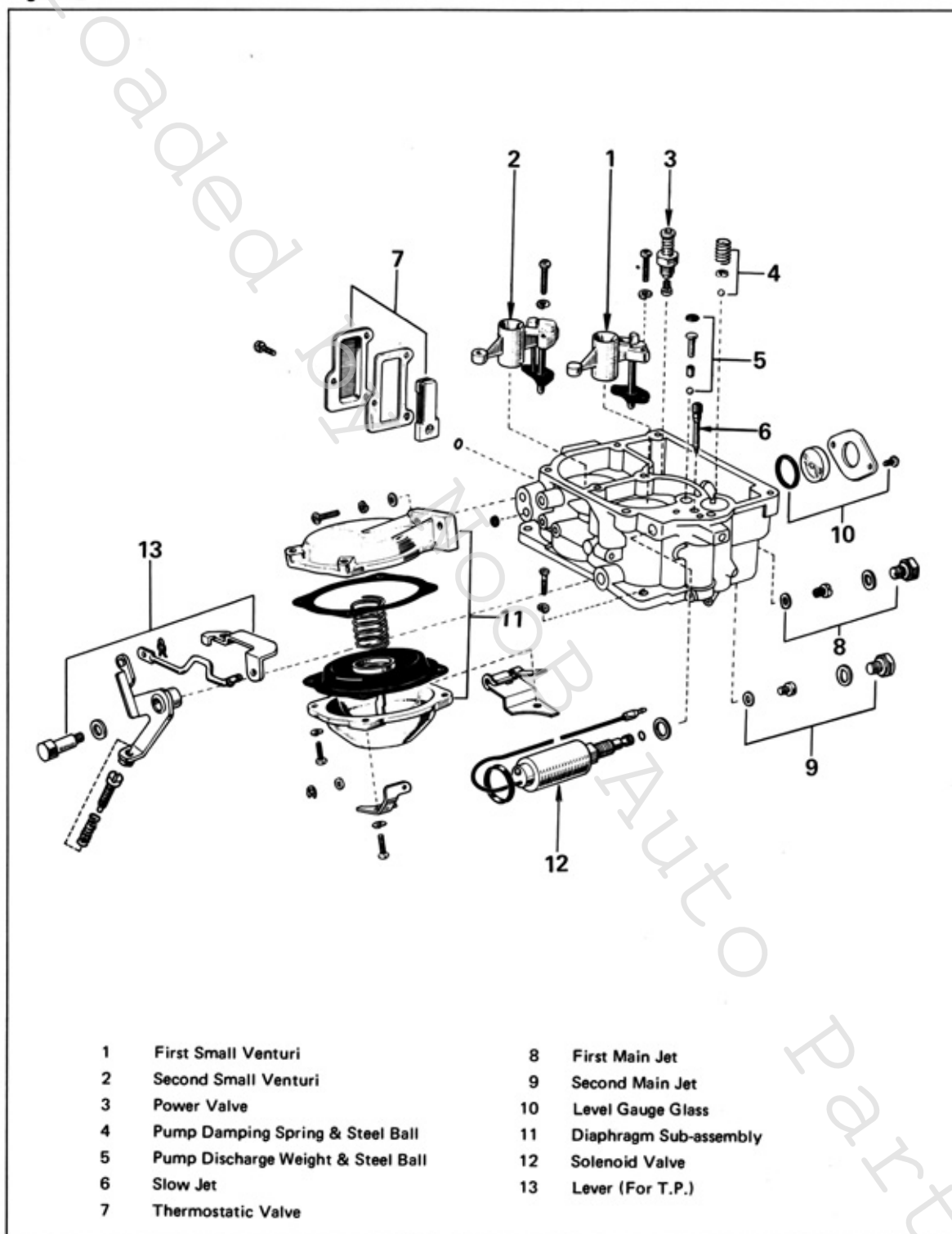


Pare off the end of set screws with a file, and remove choke valve.

Body

Disassemble in numerical order.

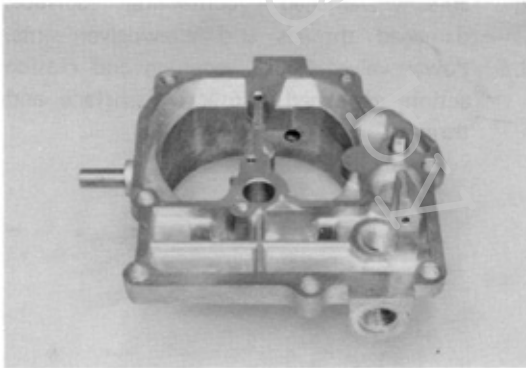
Fig. 8-12



INSPECTION**— Precaution —**

1. Before inspecting the parts, wash them thoroughly in gasoline. Using compressed air, blow all dirt and other foreign matter from the jets and similar parts, and from the fuel passages and apertures in the body.

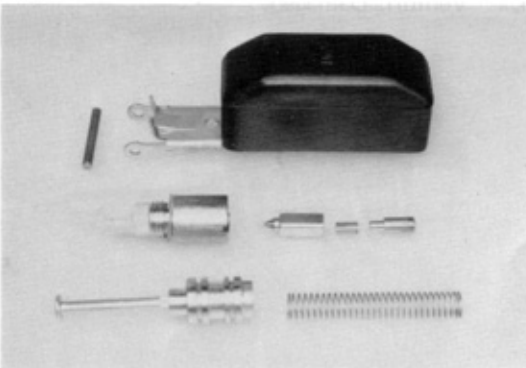
2. Never clean the jets or orifices with wire or a drill. This could enlarge the openings and result in excessive fuel consumption.

Fig. 8-13

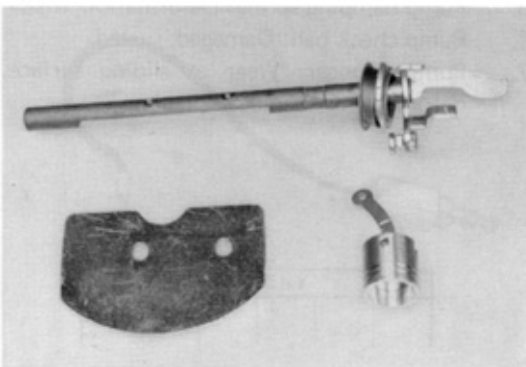
Inspect the following parts and replace any part damaged.

Air Horn Parts

1. Air horn: Cracks, damaged threads, and wear on choke shaft bores.

Fig. 8-14

2. Float: Broken lip, wear in float pivot pin holes.
3. Needle valve surface contacting valve seat.
4. Strainer: Rust, breaks.
5. Power piston: Scratches, excessive wear. Power piston spring broken or deformed.

Fig. 8-15

6. Vacuum piston: Defective sliding of piston, carbon adhering to the inside thermostat case.
7. Choke valve: Deformation. Choke shaft worn, bent, or not fitting properly into housing.

Fig. 8-16

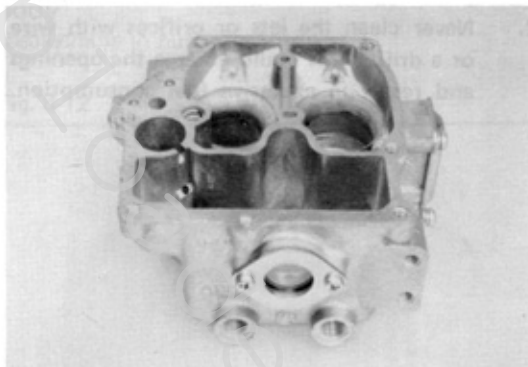


Fig. 8-17

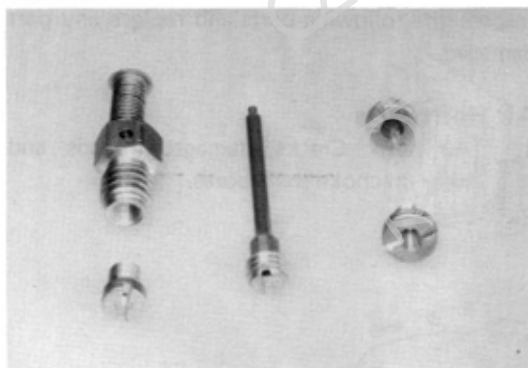


Fig. 8-18

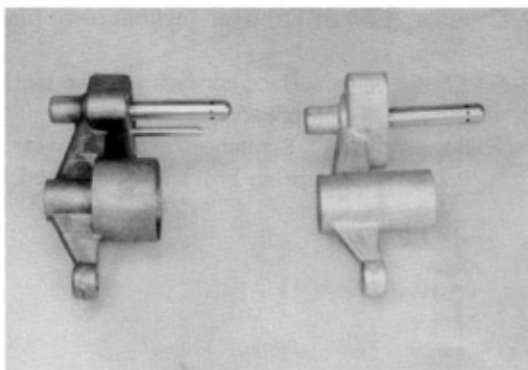
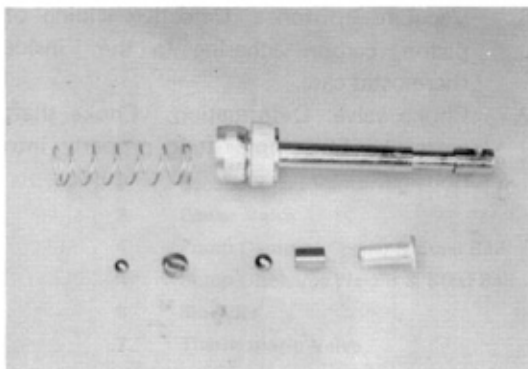


Fig. 8-19

**Body Parts**

1. Body: Cracks, scored mounting surfaces, damaged threads.



2. Jets: Damaged contacting surface, damaged threads and screwdriver slots.
3. Power valve: Faulty opening and closing action, damaged contacting surface and threads.



4. Venturi: Damaged.



5. Pump damping spring: Deformation, rust.
6. Pump check ball: Damaged, rusted.
7. Pump plunger: Wear at sliding surface, deformed or damaged leather.

Fig. 8-20

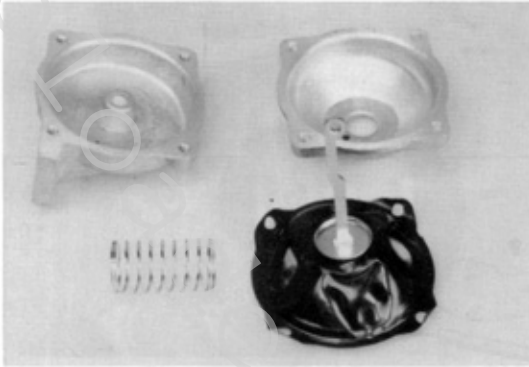


Fig. 8-21

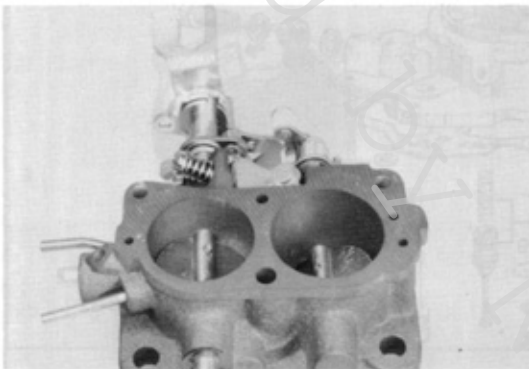


Fig. 8-22

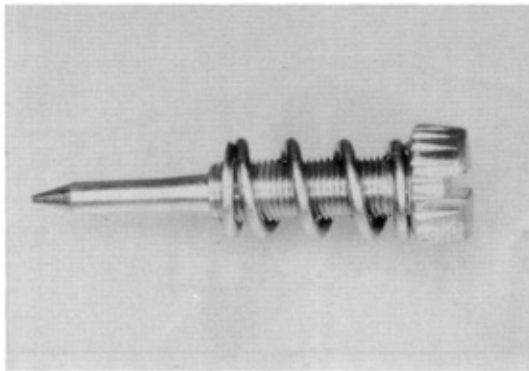
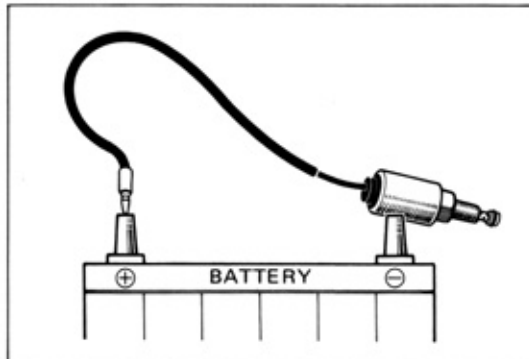


Fig. 8-23



8. Secondary diaphragm: Damaged.



Flange Parts

1. Flange: Cracks, injured mounting surfaces, damaged threads, wear at throttle shaft bearings.
2. Throttle valves: Wear or deformation in valves. Wear, bending, twisting, or faulty movement inside housing of shaft.



3. Idle mixture adjusting screw: Damage at tapered tip or threads.



Solenoid Valve

Check operation of solenoid valve.

Connect wiring to the battery positive terminal and ground the body. The needle valve should be pulled in.

ASSEMBLY

Air Horn

Assemble in numerical order.

Fig. 8-24

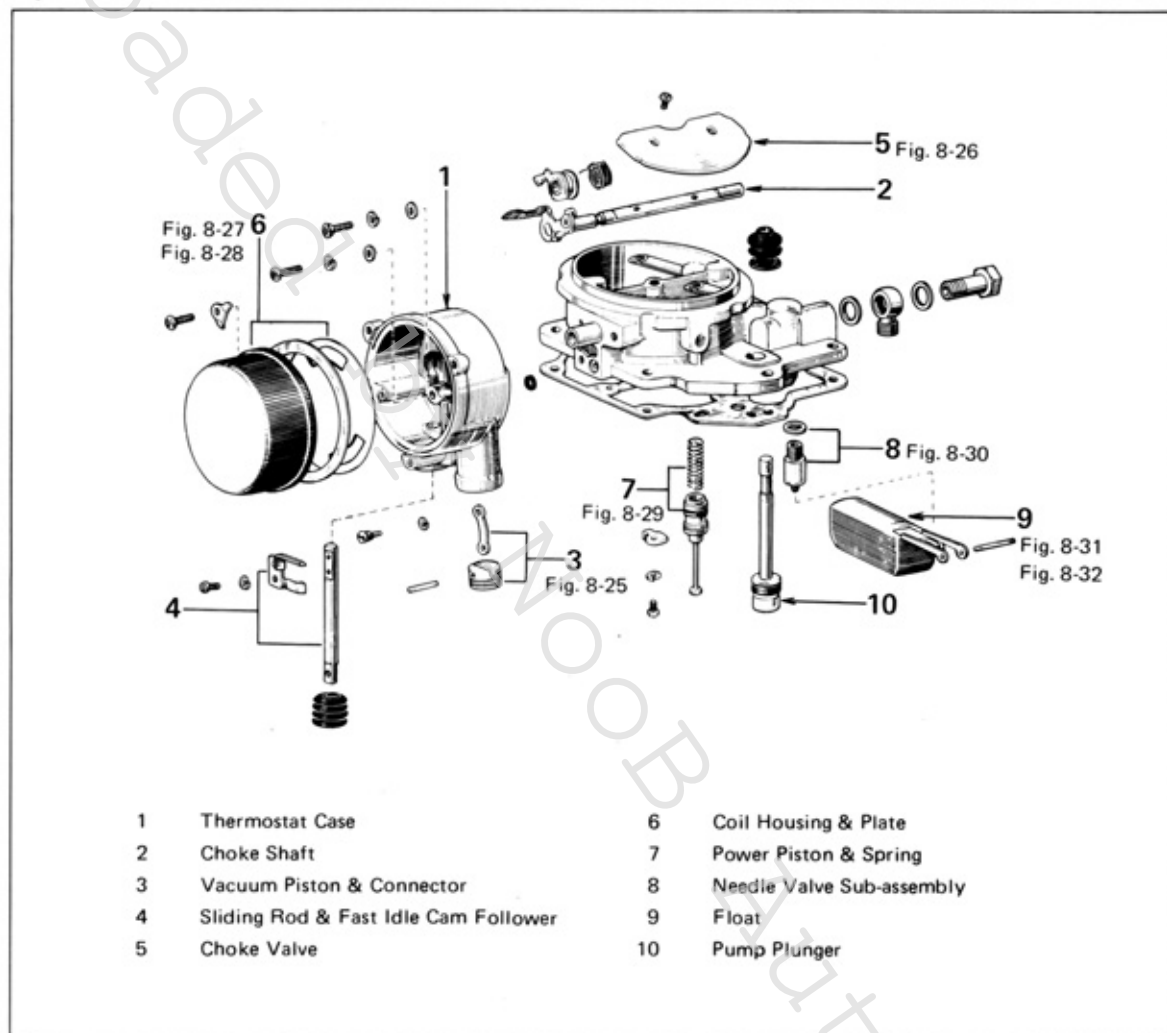
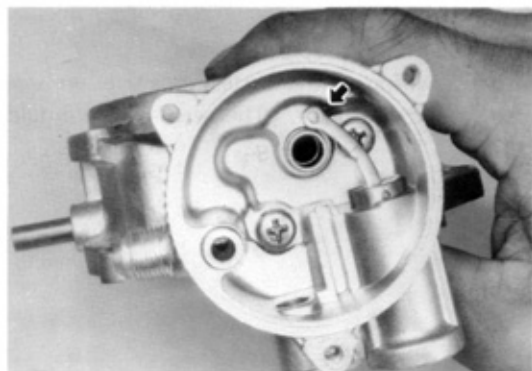
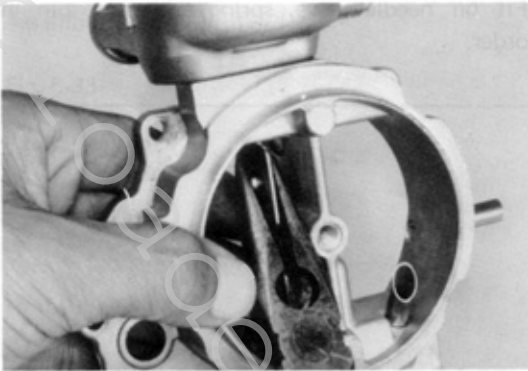


Fig. 8-25



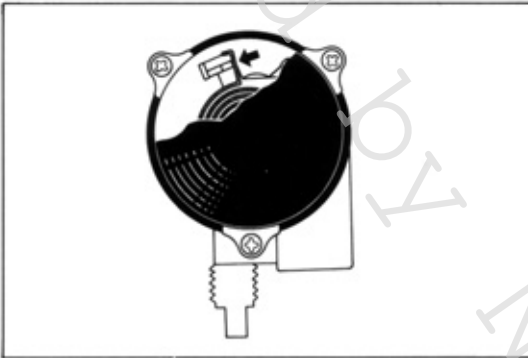
Assemble the vacuum piston in the direction as shown.

Fig. 8-26



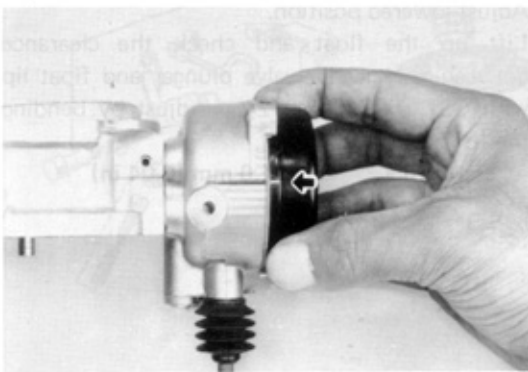
Install choke valve, then peen screws.

Fig. 8-27



Align the bimetal with the choke shaft when installing the housing.

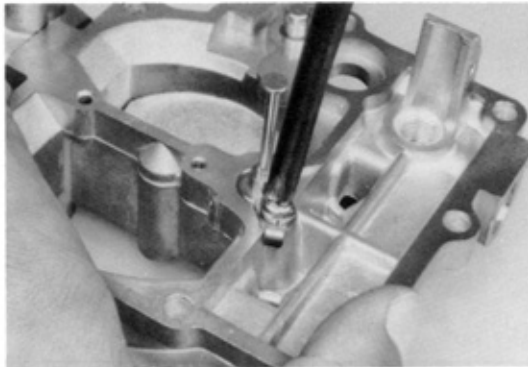
Fig. 8-28



Align the case scale center line against the housing scale line.

Check the choke valve to see that it will close completely when released from fully open position. (Atmospheric temperature below 25°C or 77°F).

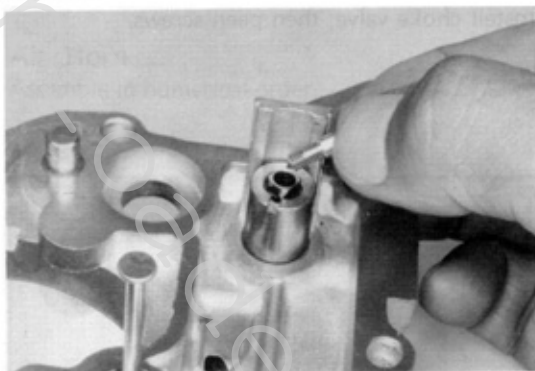
Fig. 8-29



Install power piston and spring.

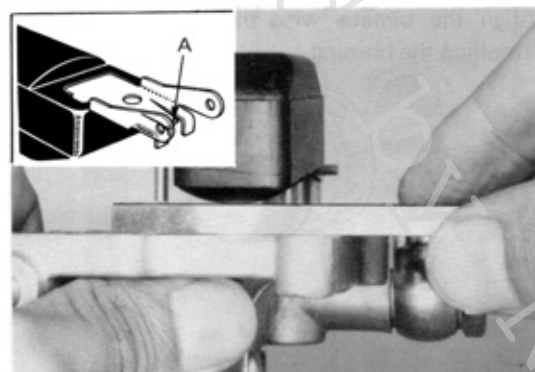
Make sure that the piston moves smoothly.

Fig. 8-30



Fit on needle valve, spring and push pin in order.

Fig. 8-31



Adjust float level.

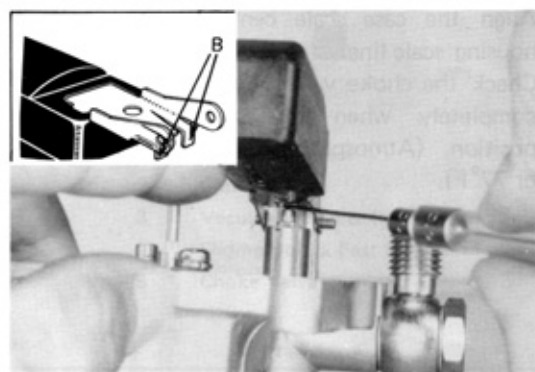
Allow the float to hang down by its own weight. Then check the clearance between the float tip and air horn with SST [09240-00012]. Adjust by bending the (A) part of float lip.

Standard **5.0 mm (0.20 in)**

—Note—

This measurement is always made without any gasket on air horn.

Fig. 8-32



Adjust lowered position.

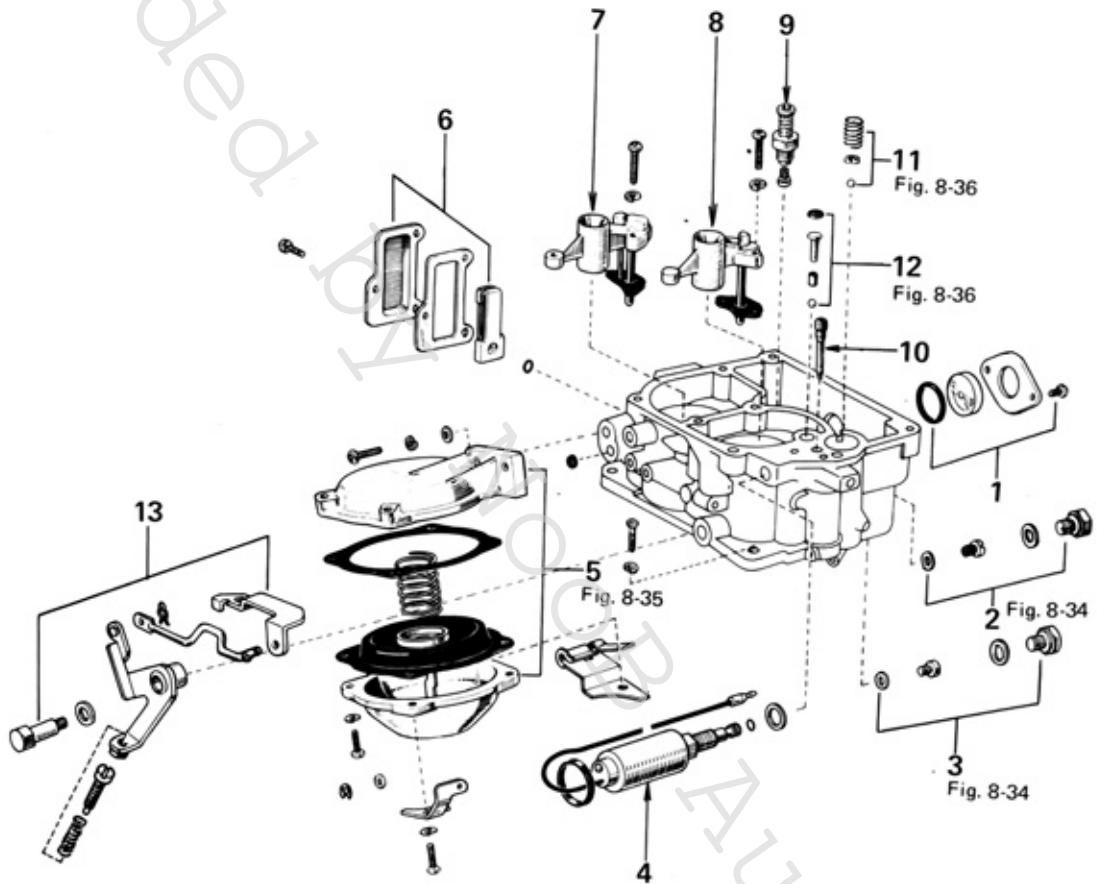
Lift up the float and check the clearance between the needle valve plunger and float lip with SST [09240-00012]. Adjust by bending the (B) part of float lip.

Standard **1.0 mm (0.04 in)**

Body

Assemble in numerical order.

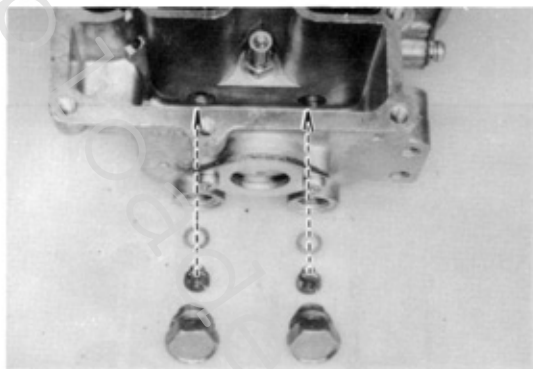
Fig. 8-33



- 1 Level Gauge Glass
- 2 First Main Jet
- 3 Second Main Jet
- 4 Solenoid Valve
- 5 Diaphragm Sub-assembly
- 6 Thermostatic Valve
- 7 Second Small Venturi

- 8 First Small Venturi
- 9 Power Valve
- 10 Slow Jet
- 11 Pump Damping Spring & Steel Ball
- 12 Pump Discharge Weight & Steel Ball
- 13 Lever (For T.P.)

Fig. 8-34



Install main jets over gasket.

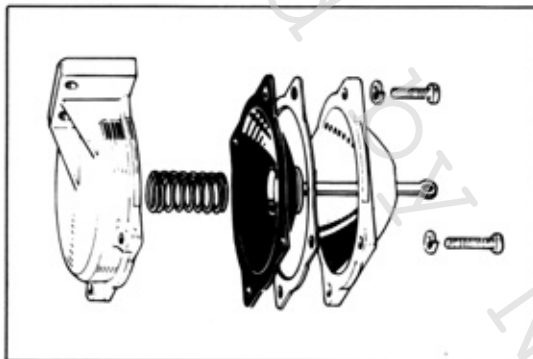
Primary jet

Brass colored

Secondary jet

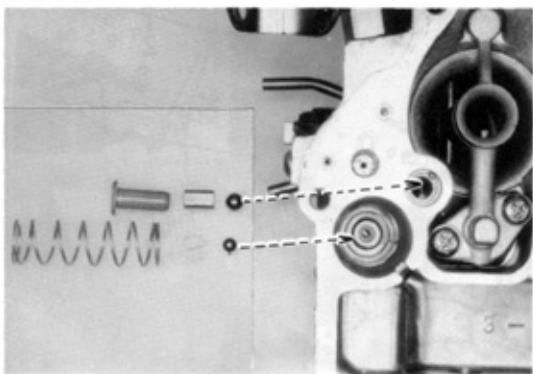
Chrome colored

Fig. 8-35



Assemble secondary diaphragm in order as shown.

Fig. 8-36



Install pump outlet ball and weight.

— Note —

There are two sizes of balls.

Larger ball: For Pump outlet.

Smaller ball: For Pump inlet.

Body And Air Horn

Assemble in numerical order.

Fig. 8-37

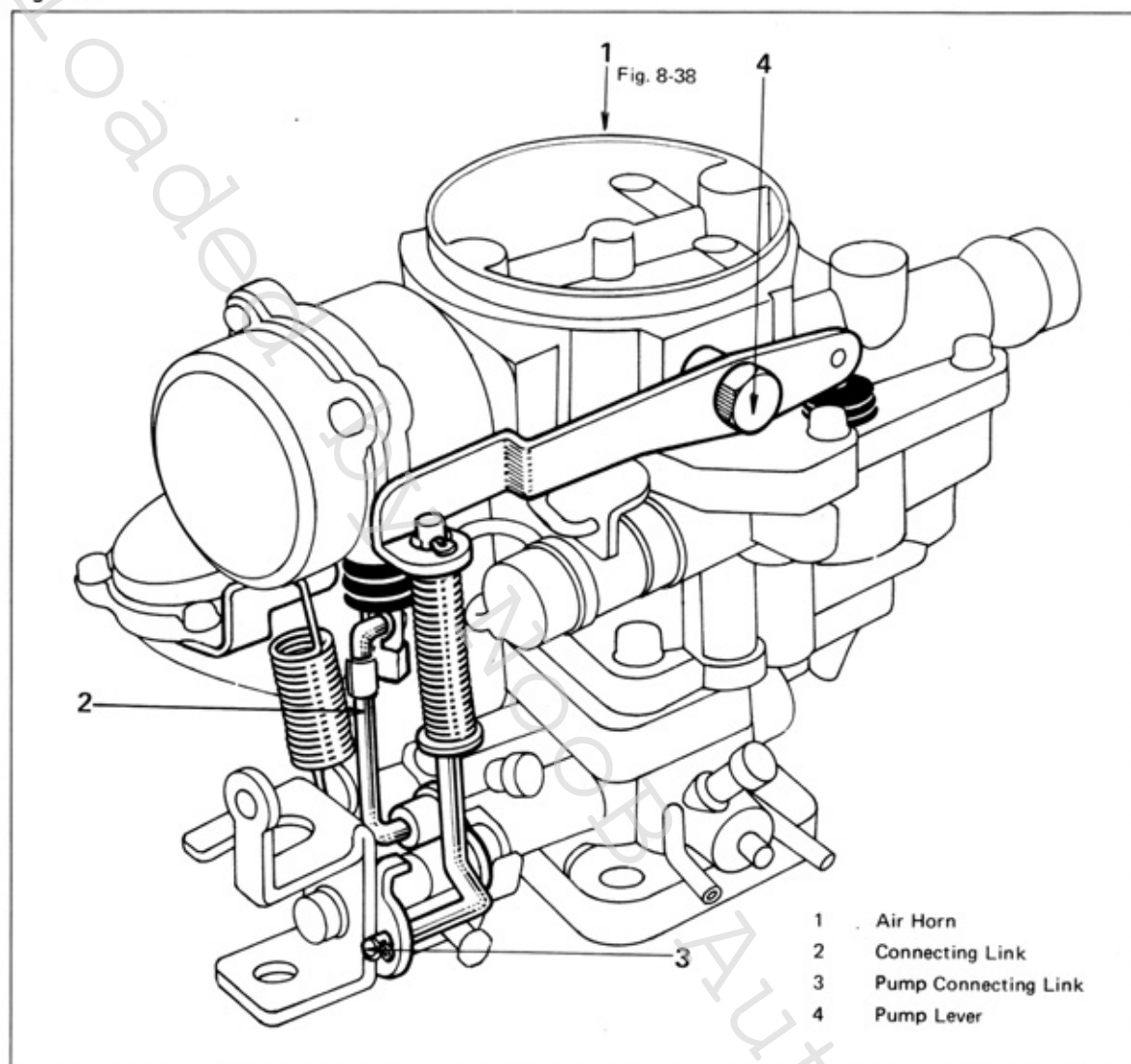
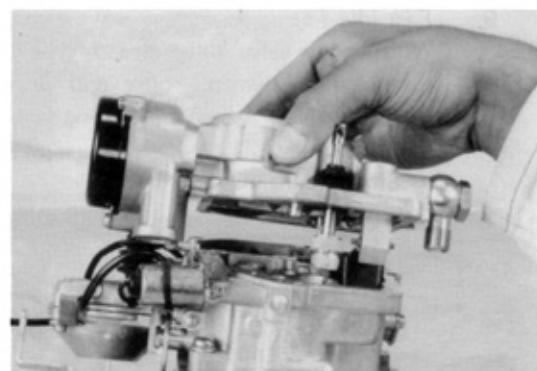


Fig. 8-38



Assemble body and air horn over new gasket.
Take care not to damage pump plunger leather.

Fig. 8-39

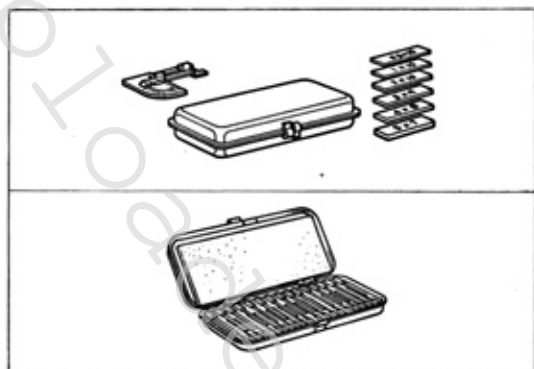


Fig. 8-40

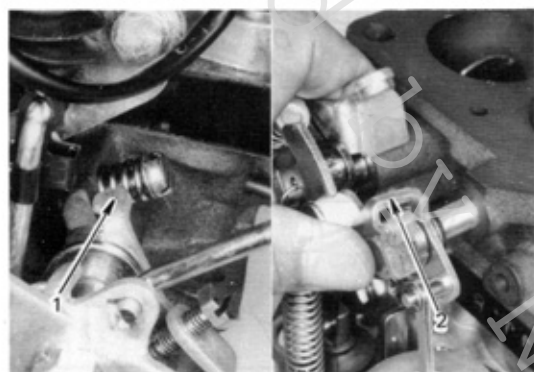


Fig. 8-41

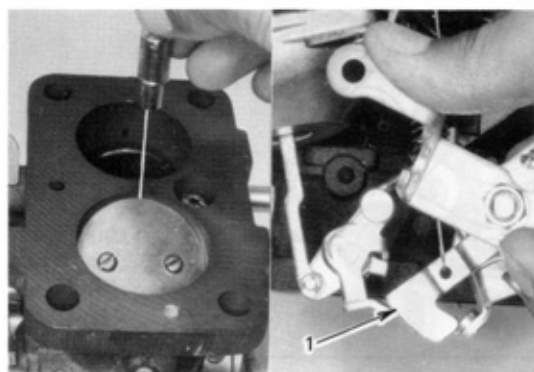
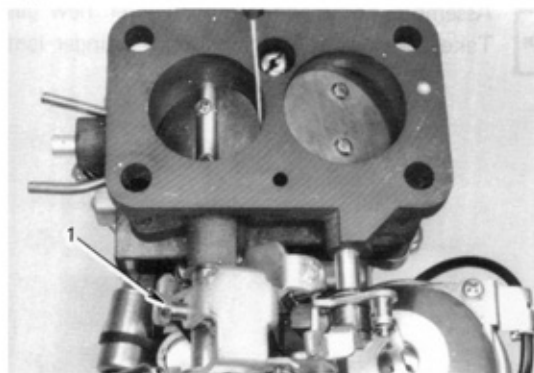


Fig. 8-42



ADJUSTMENT

Use SST [09240-00014 and 09240-00020] to make adjustments.

1. Throttle valve openings
Open the primary and secondary throttle valves separately and check if the throttle valves will be perpendicular to the flange surface when fully opened. Adjust by bending the respective throttle lever stoppers at the primary (1) and secondary sides (2).

2. Kick up
Adjust the clearance between the second throttle valve and body by bending the second throttle lever (1).

With first throttle valve opening
64 ~ 90°

Standard clearance
0.2 mm (0.0079 in)

3. Fast idle
With choke valve fully closed, check the clearance between bore and primary throttle valve. Adjust by turning fast idle adjusting screw (1).

Standard clearance
1.0 mm (0.04 in)

Fig. 8-43

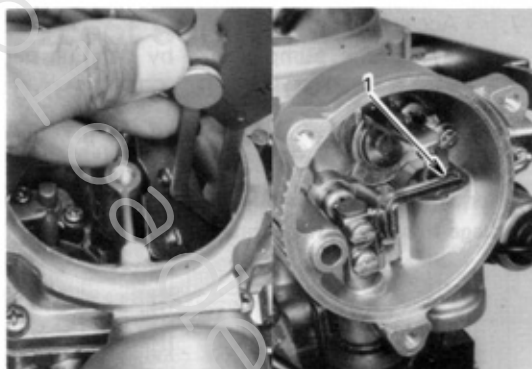


Fig. 8-44

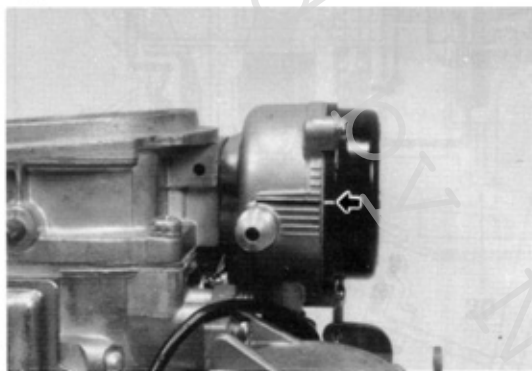


Fig. 8-45

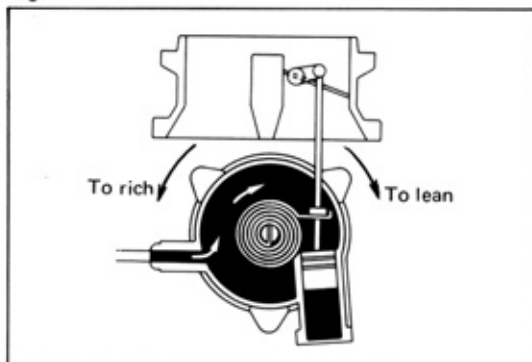
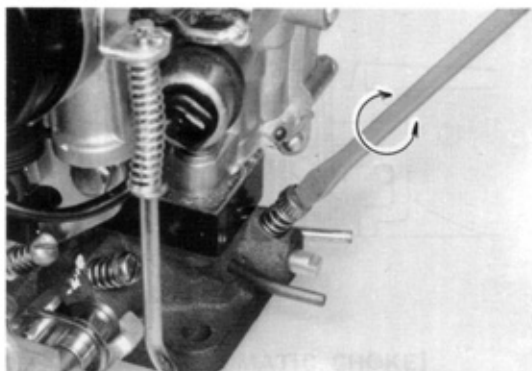


Fig. 8-46



4. Unloader
With the first throttle valve fully opened, adjust the choke valve angle by bending the fast idle cam follower or choke shaft lip (1).

Standard angle **47° from bore**

5. Automatic choke
(1) Set the coil housing scale mark so that it will be aligned with the center line of the thermostat case.

— Note —

The choke valve becomes fully closed when atmospheric temperature reaches 25°C (77°F).

- (2) Depending on the vehicle operating conditions, turn the coil housing and adjust the engine starting mixture.

If too rich Turn clock-wise.

If too lean Turn counterclock-wise.

— Note —

One graduation of thermostat case scale equals 5°C (9°F) change.

6. Idle mixture adjusting screw
Screw in the idle mixture adjusting screw and then unscrew it by the following amount.

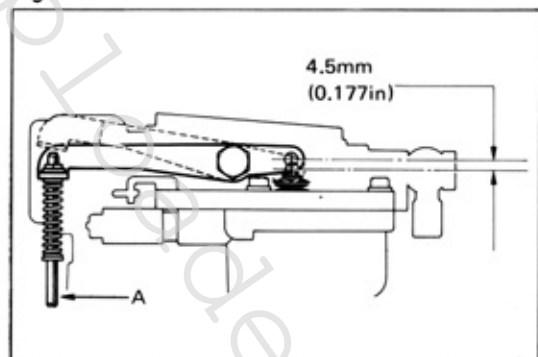
Standard (Reference only)

Returned about 2½ turns from full closed

— Caution —

Take care not to screw in too tightly and damage the screw tip.

Fig. 8-47



7. Accelerating pump
Adjust the pump stroke by bending part (A).

Standard 4.5 mm (0.177 in)

— Note —

After adjustment is made, be sure to check the linkage to see that it operates smoothly.

CARBURETOR (FOR 18R ENGINE) Except South Africa

CARBURETOR CIRCUITS

Fig. 8-50

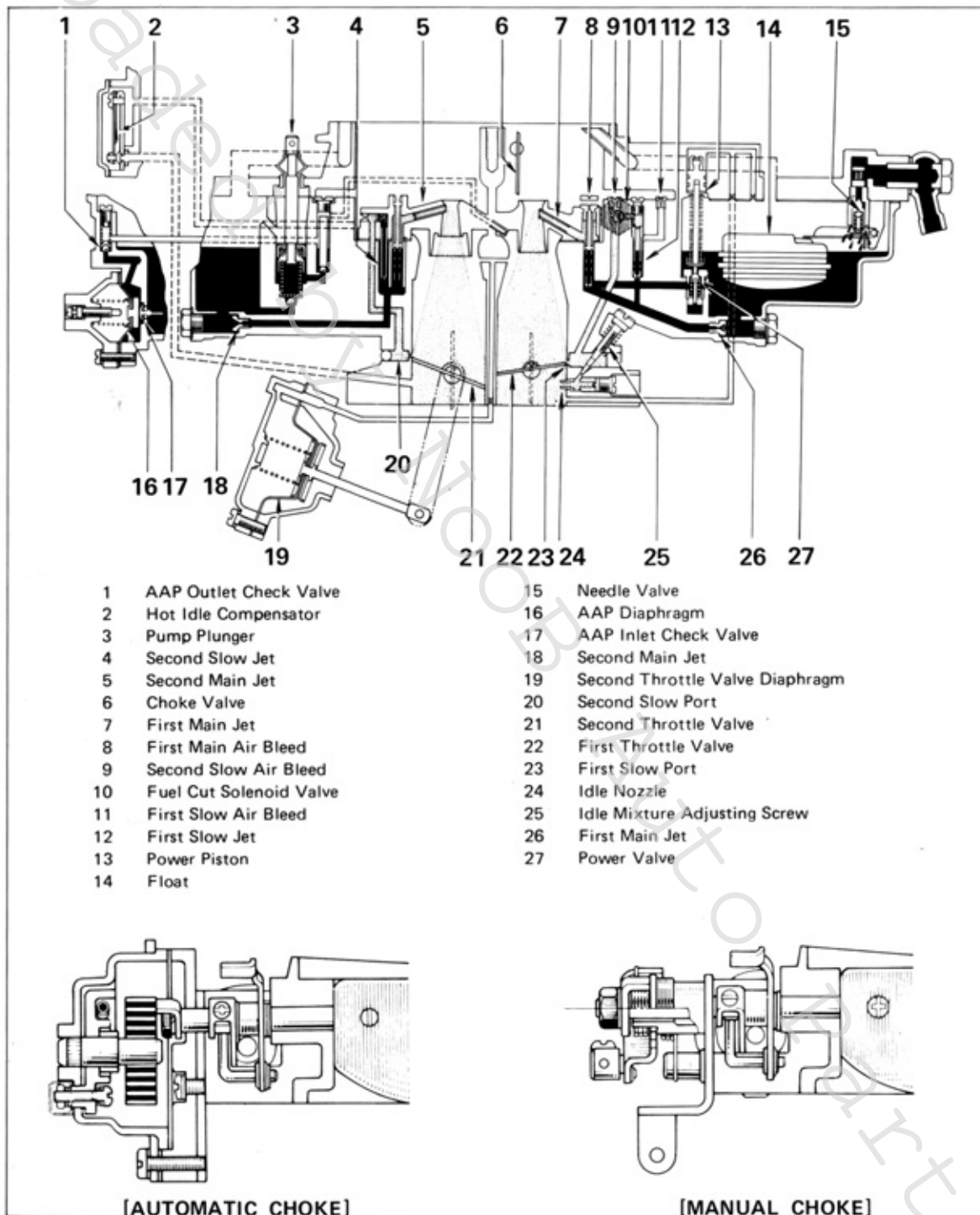
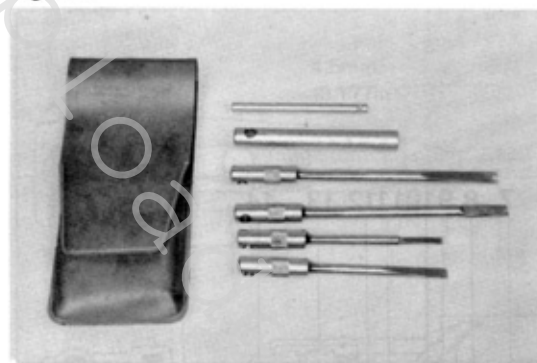


Fig. 8-51



Use SST [09860-11011] for carburetor servicing.

DISASSEMBLY

Air Horn

Disassemble in numerical order.

Fig. 8-52

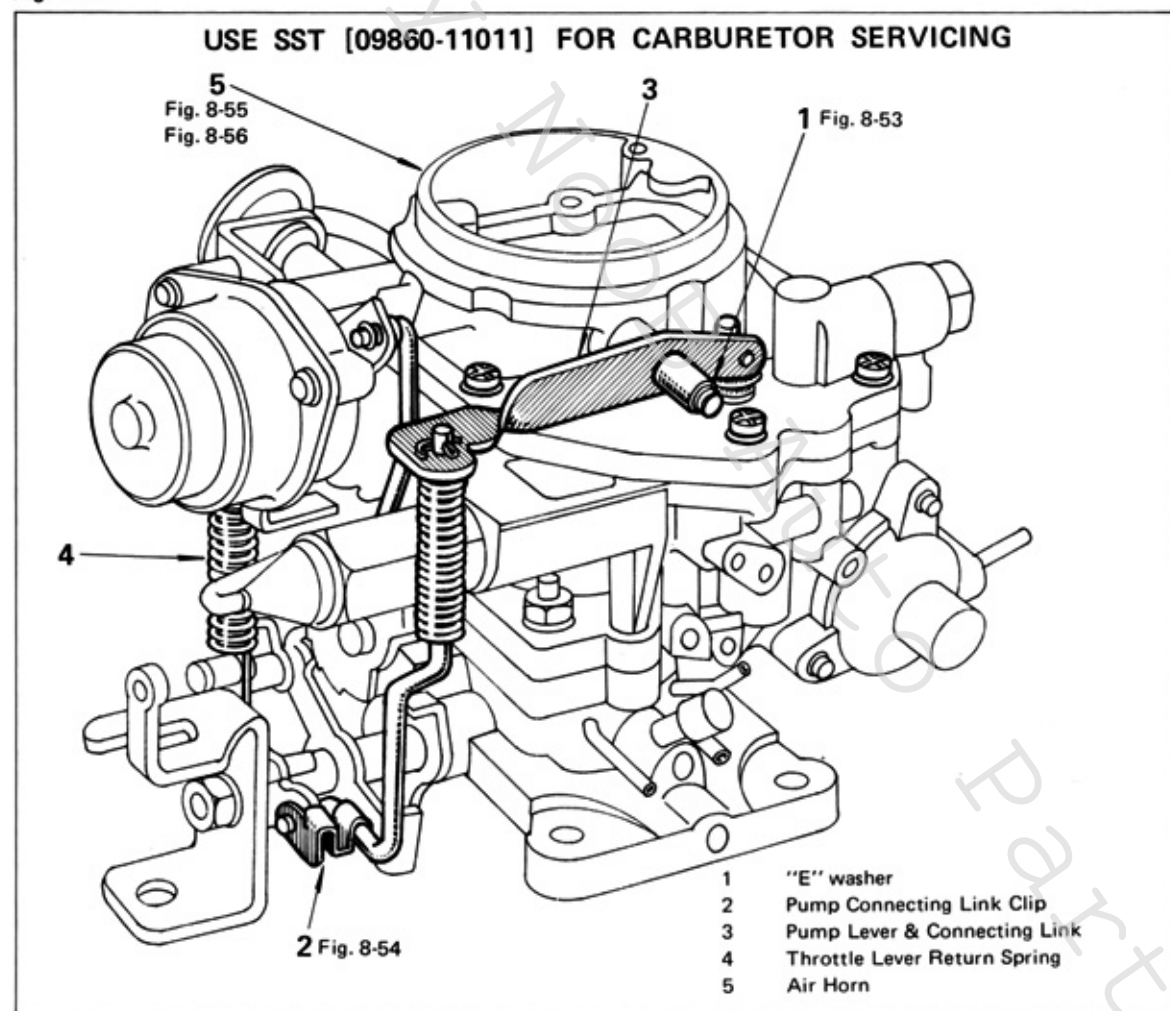
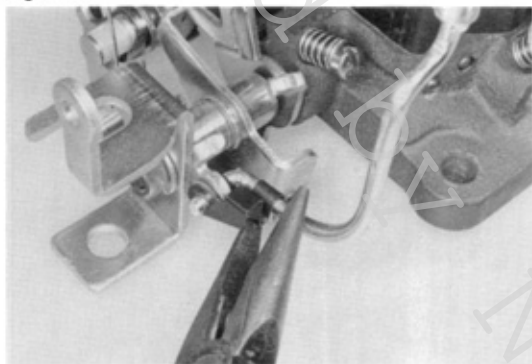


Fig. 8-53



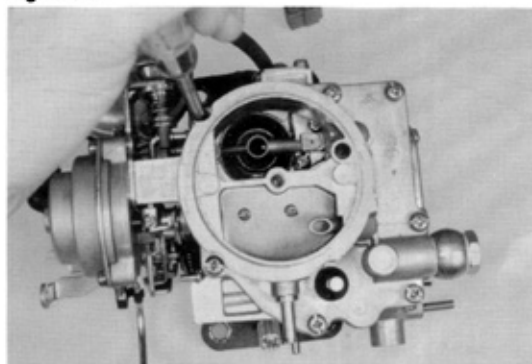
Remove "E" washer with a small screwdriver.

Fig. 8-54



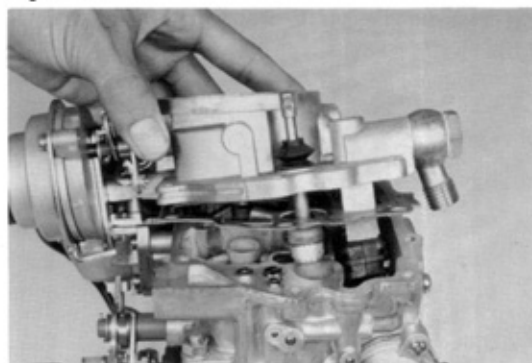
Disconnect pump connecting link from throttle shaft lever.

Fig. 8-55



Gradually loosen air horn set screw in 2 or 3 stages in diagonal order.

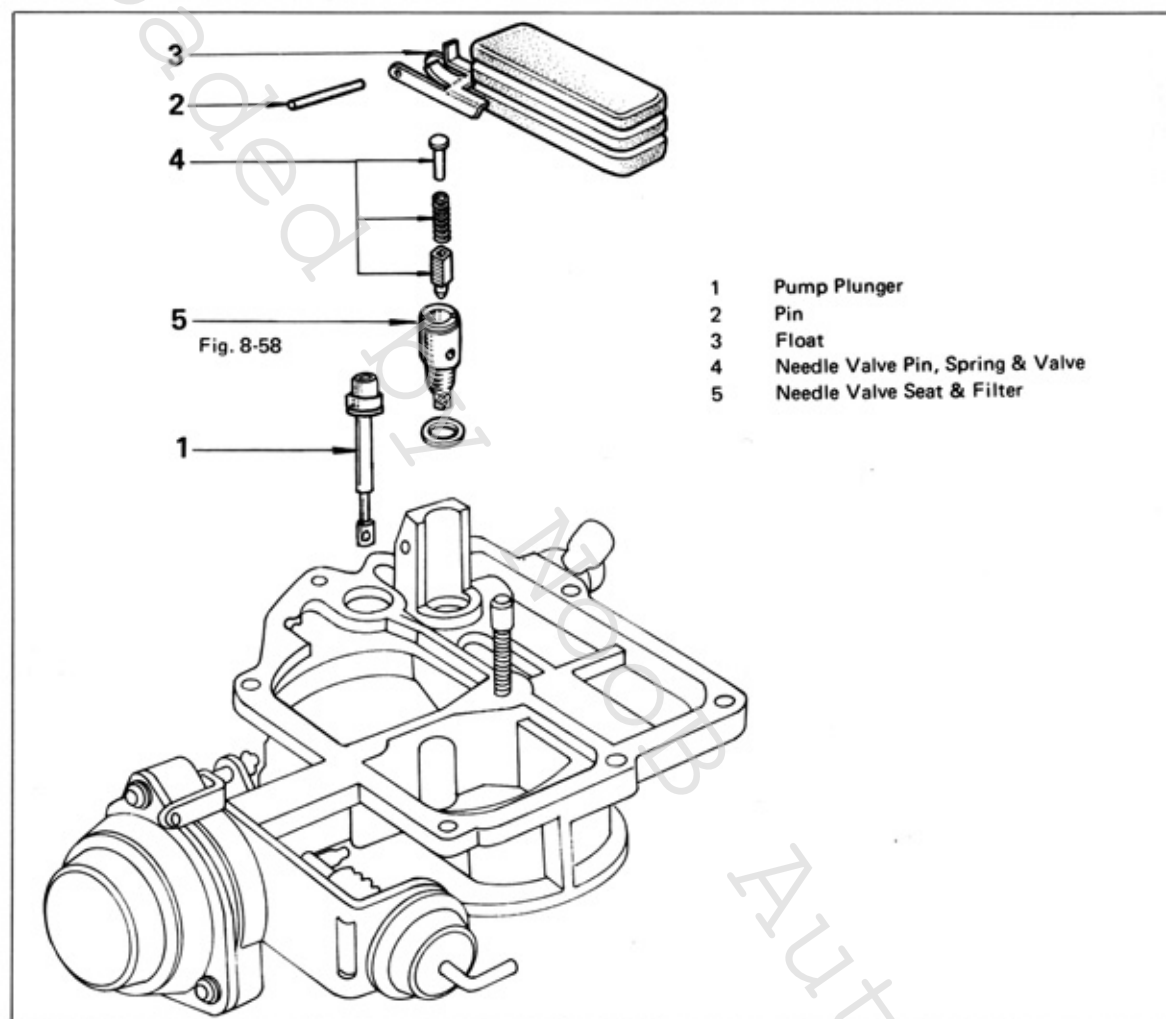
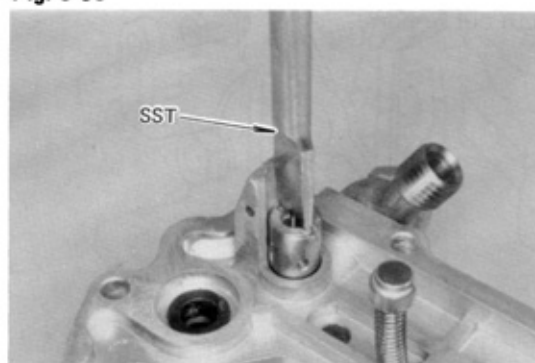
Fig. 8-56



Lift out air horn.

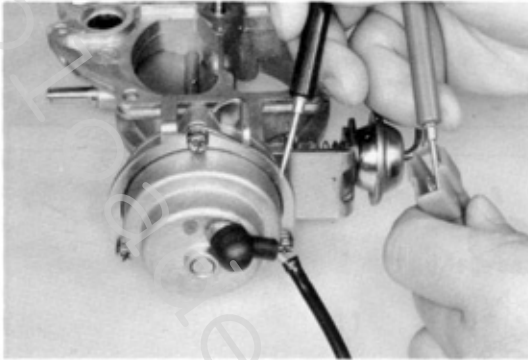
Float

Disassemble in numerical order.

Fig. 8-57**Fig. 8-58**

Remove needle valve seat with SST [09860-11011].

Fig. 8-59

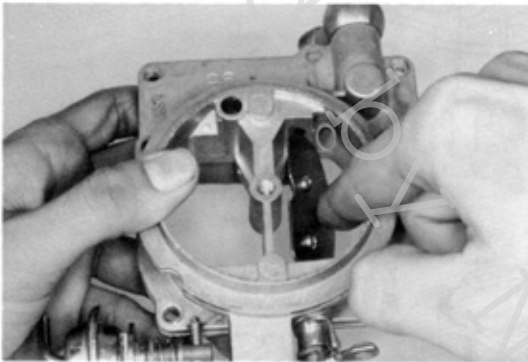
**Air Horn**

Before disassembling, check following items.

1. Measure heating coil resistance with ohmmeter.

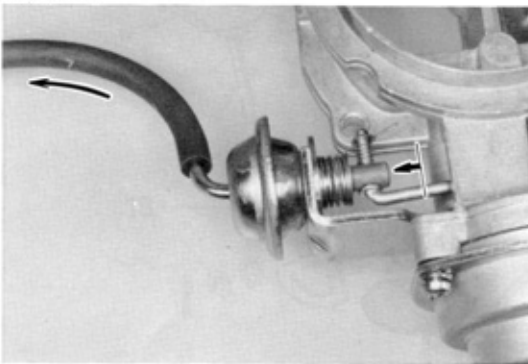
Resistance **7.5 — 10.0 Ω**

Fig. 8-60



2. Check choke valve action.

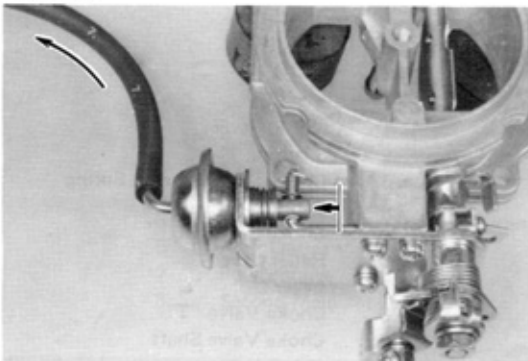
Fig. 8-61



3. Check choke breaker diaphragm action.

Automatic choke

Fig. 8-62

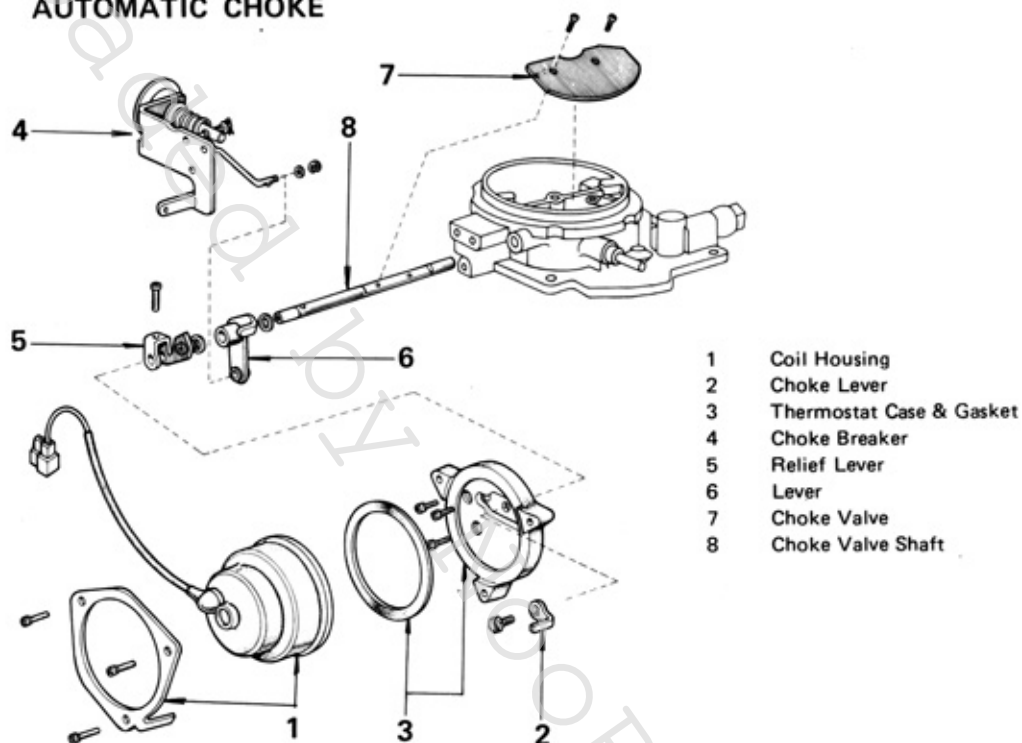


Manual choke

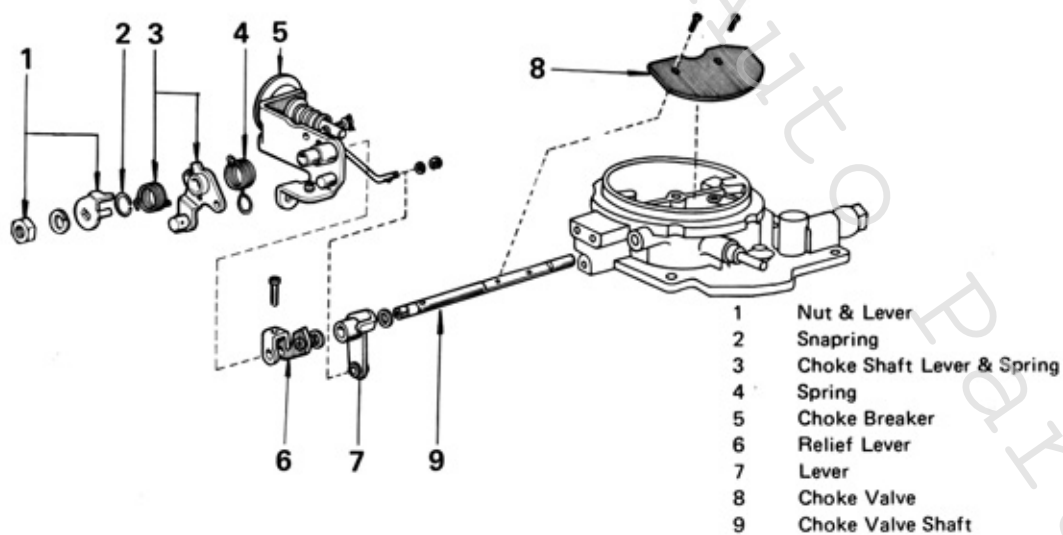
Disassemble in numerical order.

Fig. 8-63

AUTOMATIC CHOKE



NANUAL CHOKE



Body

Disassemble in numerical order.

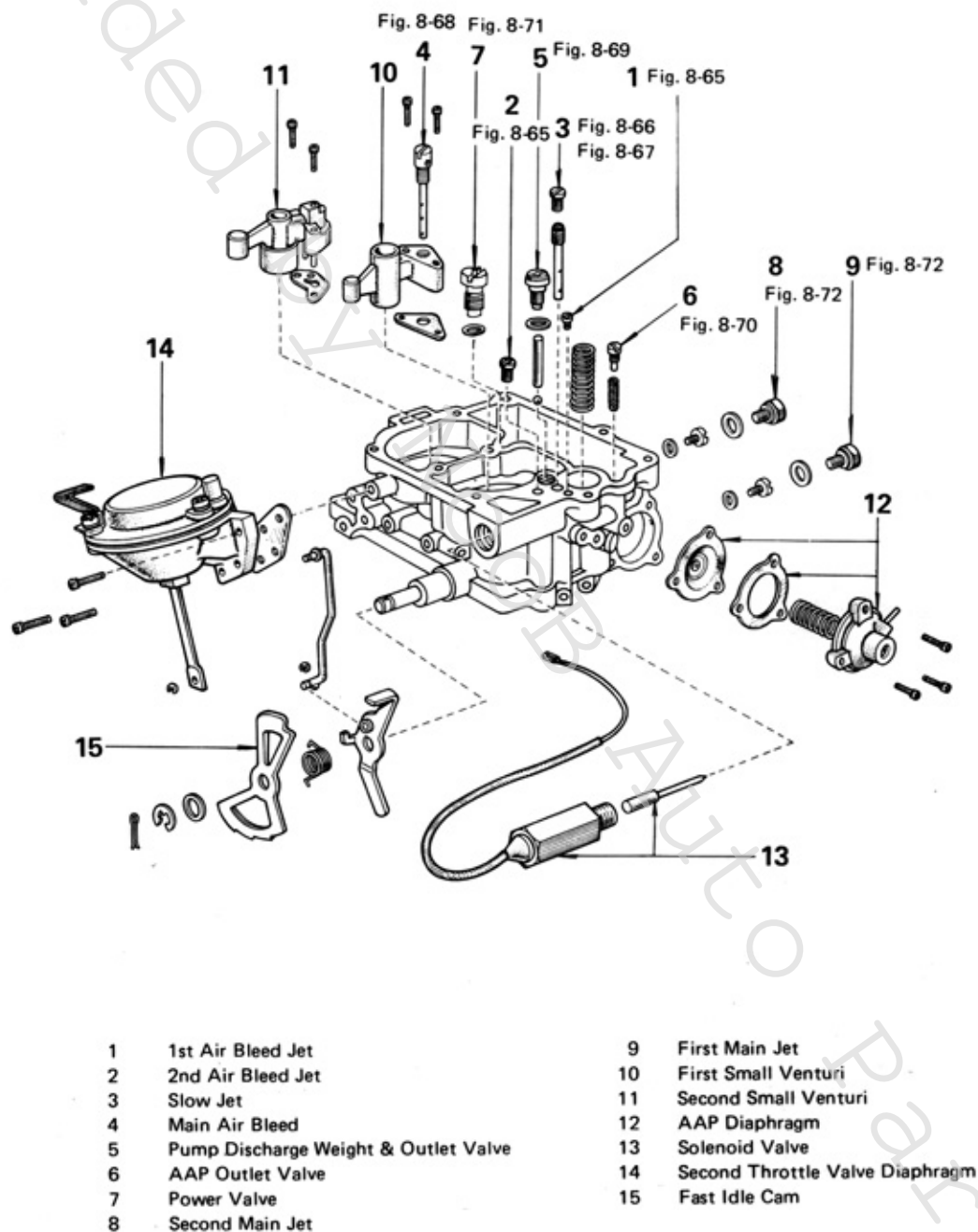
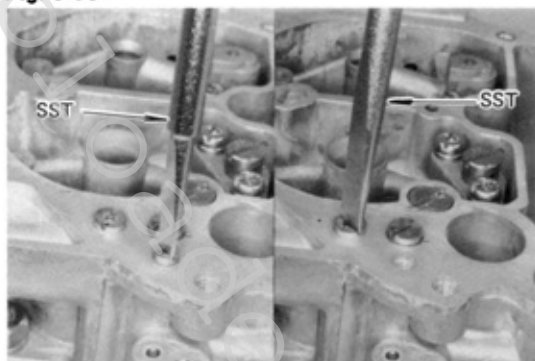
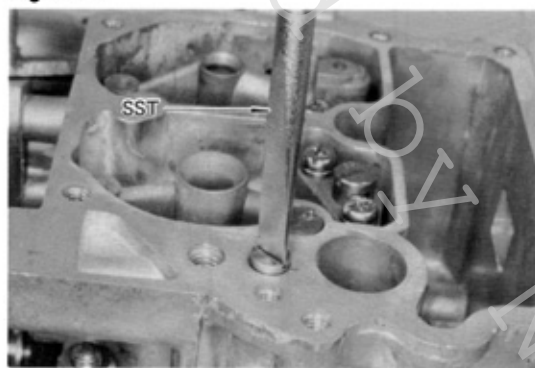
Fig. 8-64

Fig. 8-65



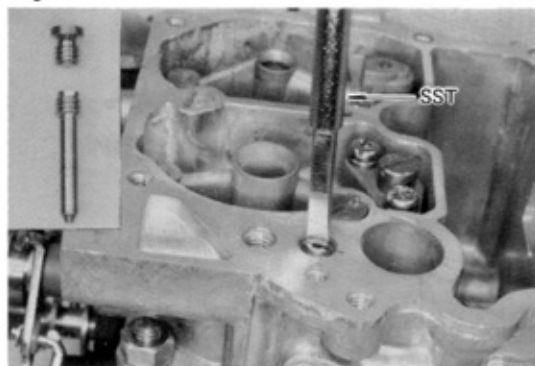
Remove 1st and 2nd slow air bleed jet with SST [09860-11011].

Fig. 8-66



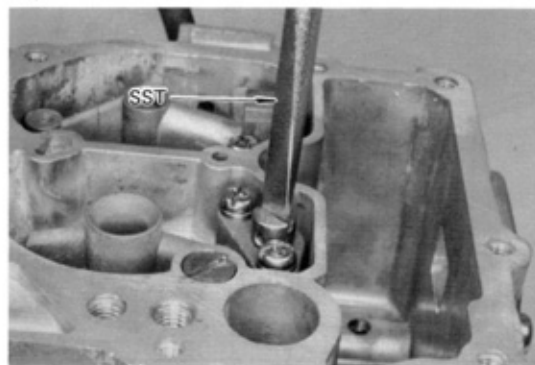
Remove slow jet plug with SST [09860-11011].

Fig. 8-67



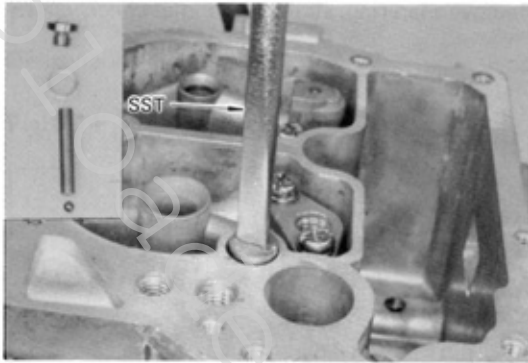
Remove slow jet with SST [09860-11011].

Fig. 8-68



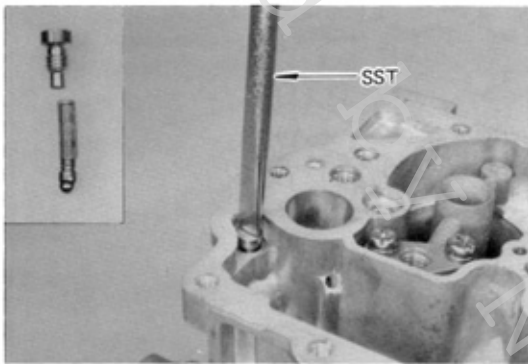
Remove 1st main air bleed with SST [09860-11011].

Fig. 8-69



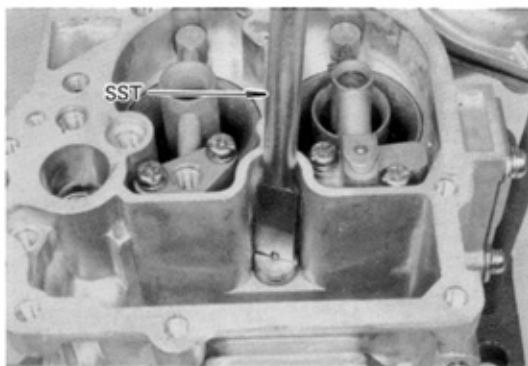
Remove discharge weight plug with SST [09860-11011], then remove discharge weight and outlet check valve.

Fig. 8-70



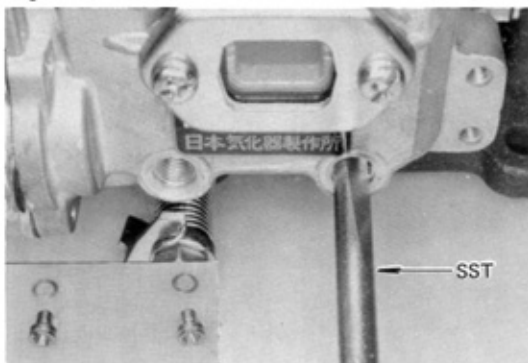
Remove AAP outlet valve plug with SST [09860-11011], then remove spring and outlet check valve.

Fig. 8-71



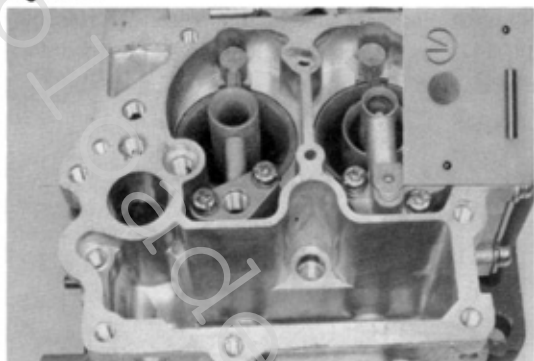
Remove power valve with SST [09860-11011].

Fig. 8-72



Remove 1st, 2nd main jet and gaskets.

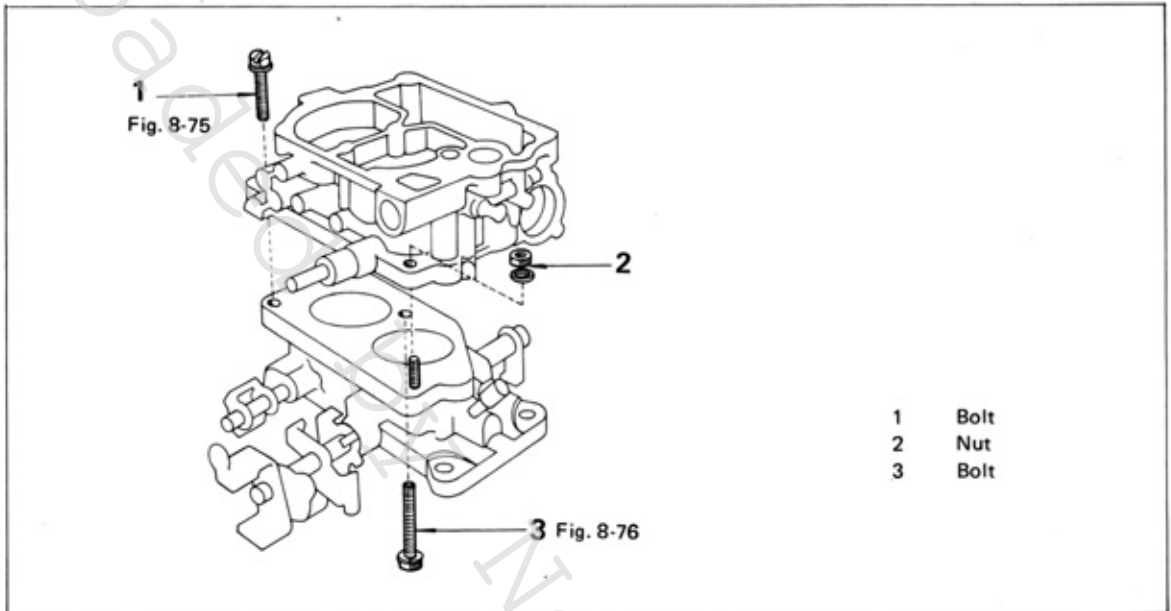
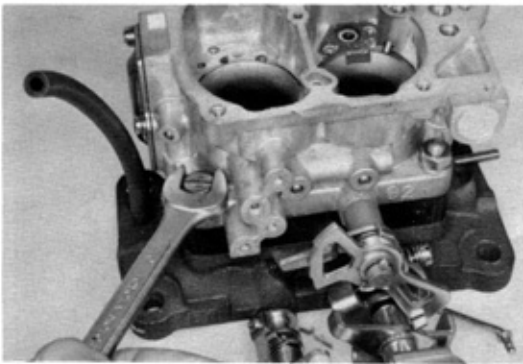
Fig. 8-73



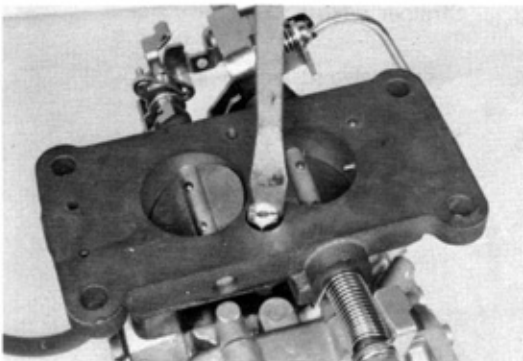
Remove snap ring, strainer and inlet check valve.

Flange

Disassemble in numerical order.

Fig. 8-74**Fig. 8-75**

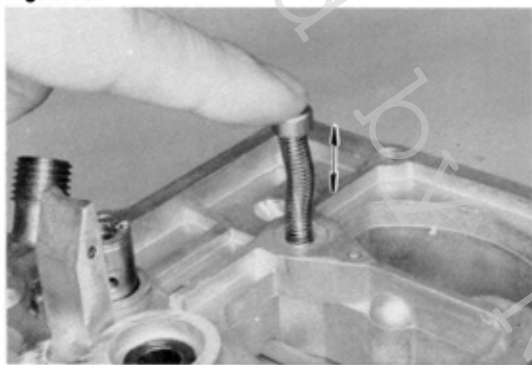
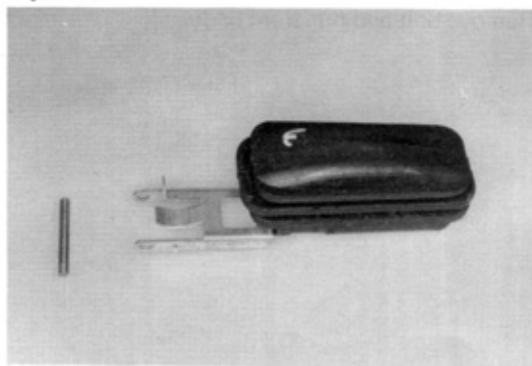
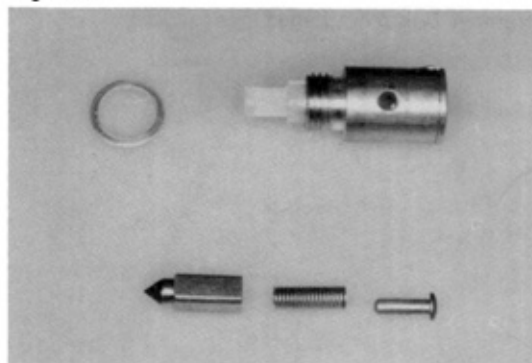
Remove bolt and nut from body.

Fig. 8-76

Remove bolt from flange.

INSPECTION**— Precaution —**

1. Before inspecting the parts, wash them thoroughly in gasoline. Using compressed air, blow all dirt and other foreign matter from the jets and similar parts, and from the fuel passages and apertures in the body.
2. Never clean the jets or orifices with wire or a drill. This could enlarge the openings and result in excessive fuel consumption.

Fig. 8-77**Fig. 8-78****Fig. 8-79****Air Horn Parts**

1. Make sure that power piston moves smoothly.

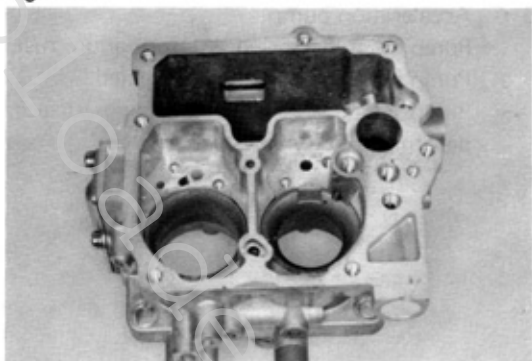


2. Check float and pivot pin for wear or broken.



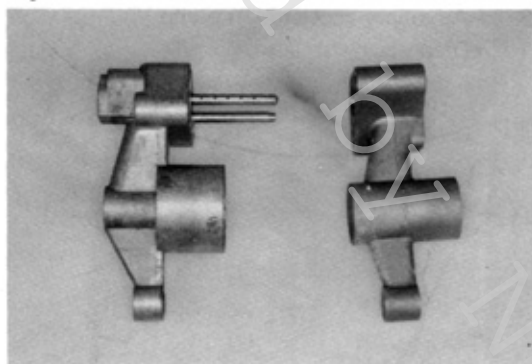
3. Strainer : Rust, breaks.
4. Needle valve surface.
5. Needle valve seat.

Fig. 8-80

**Body Parts**

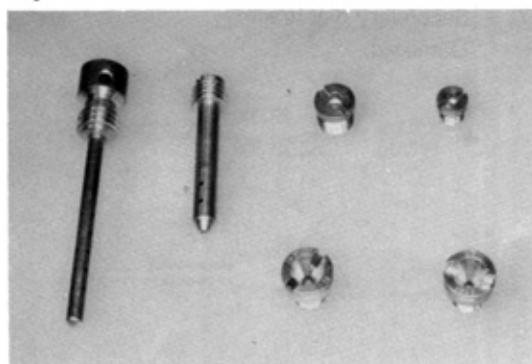
1. Body
Cracks, scored mounting surfaces, damaged threads.

Fig. 8-81



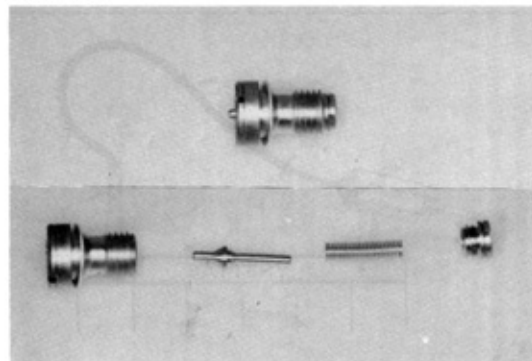
2. Venturi
Damaged.

Fig. 8-82



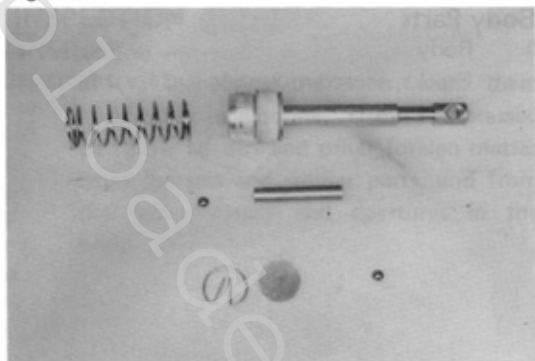
3. Jets
Damaged contacting surface, damaged threads and screwdriver slots.

Fig. 8-83



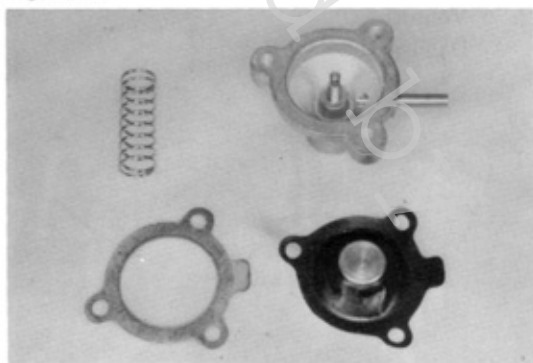
4. Power valve
Faulty opening and closing action, damaged contacting surface and threads.

Fig. 8-84



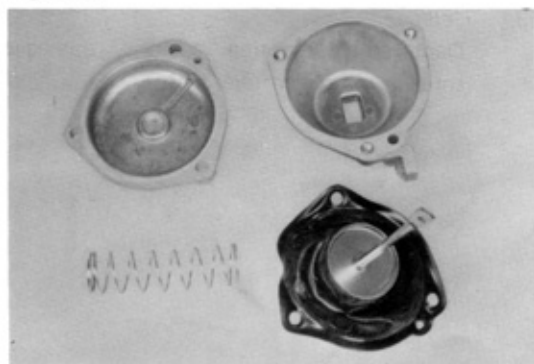
5. Acceleration pump
 Pump damping spring: Deformation, rust.
 Pump check ball: Damaged, rusted.
 Pump plunger: Wear at sliding surface, deformed or damaged leather.

Fig. 8-85



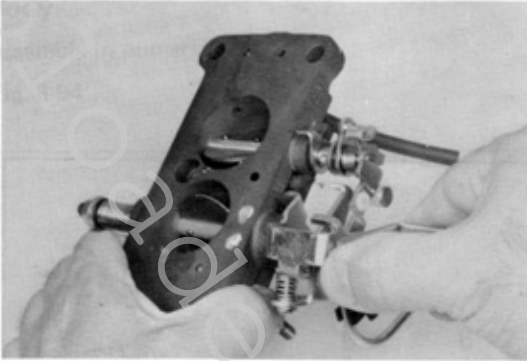
6. Auxiliary acceleration pump
 Diaphragm damaged.

Fig. 8-86



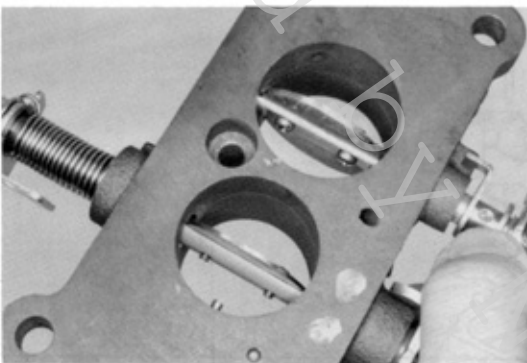
7. Secondary diaphragm
 Damaged.

Fig. 8-87

**Flange Parts**

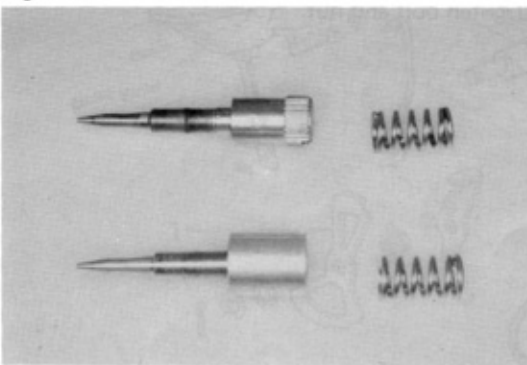
1. Flange: Cracks, injured mounting surfaces, damaged threads, wear at throttle shaft bearings.

Fig. 8-88



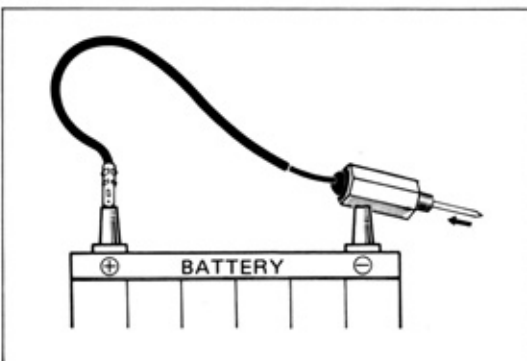
2. Throttle valves: Wear or deformation in valves. Wear, bending, twisting, or faulty movement inside housing of shaft.

Fig. 8-89



3. Idle mixture adjusting screw: Damage at tapered tip or threads.

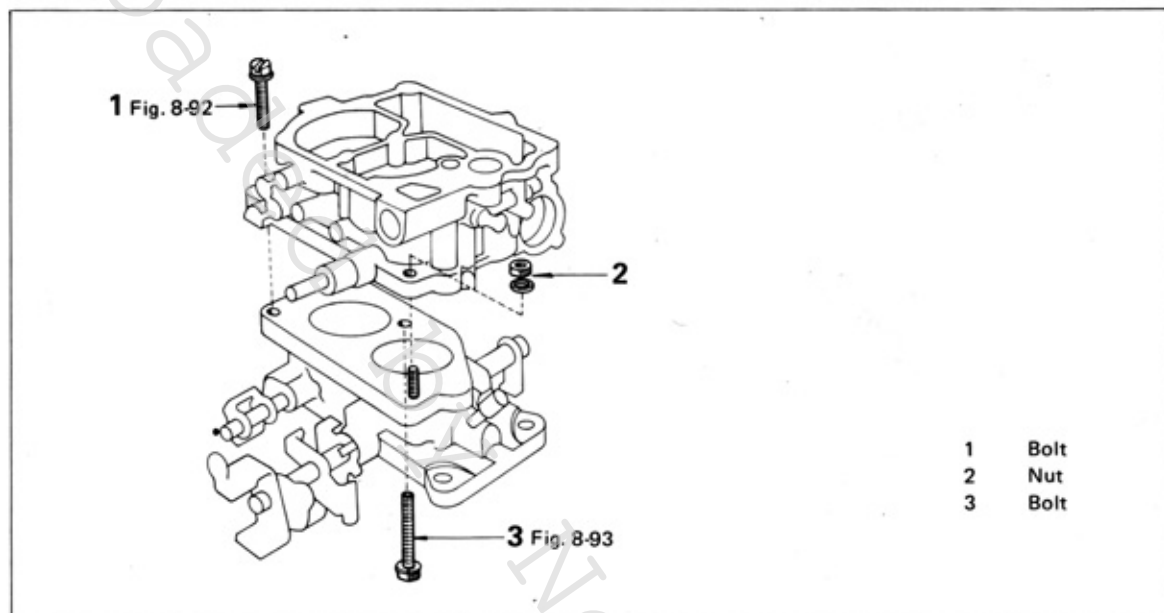
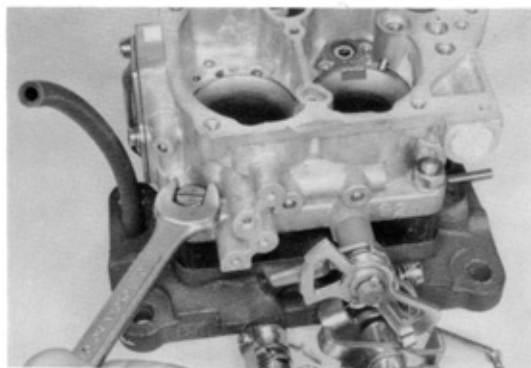
Fig. 8-90

**Solenoid Valve**

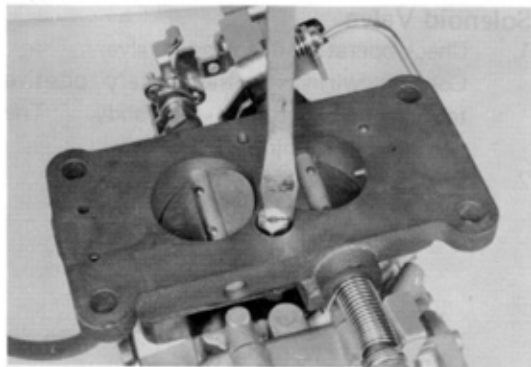
1. Check operation of solenoid valve. Connect wiring to the battery positive terminal and ground the body. The needle valve should be pulled in.
2. Check needle valve "A" part.

ASSEMBLY

Assemble in numerical order.

Fig. 8-91**Fig. 8-92**

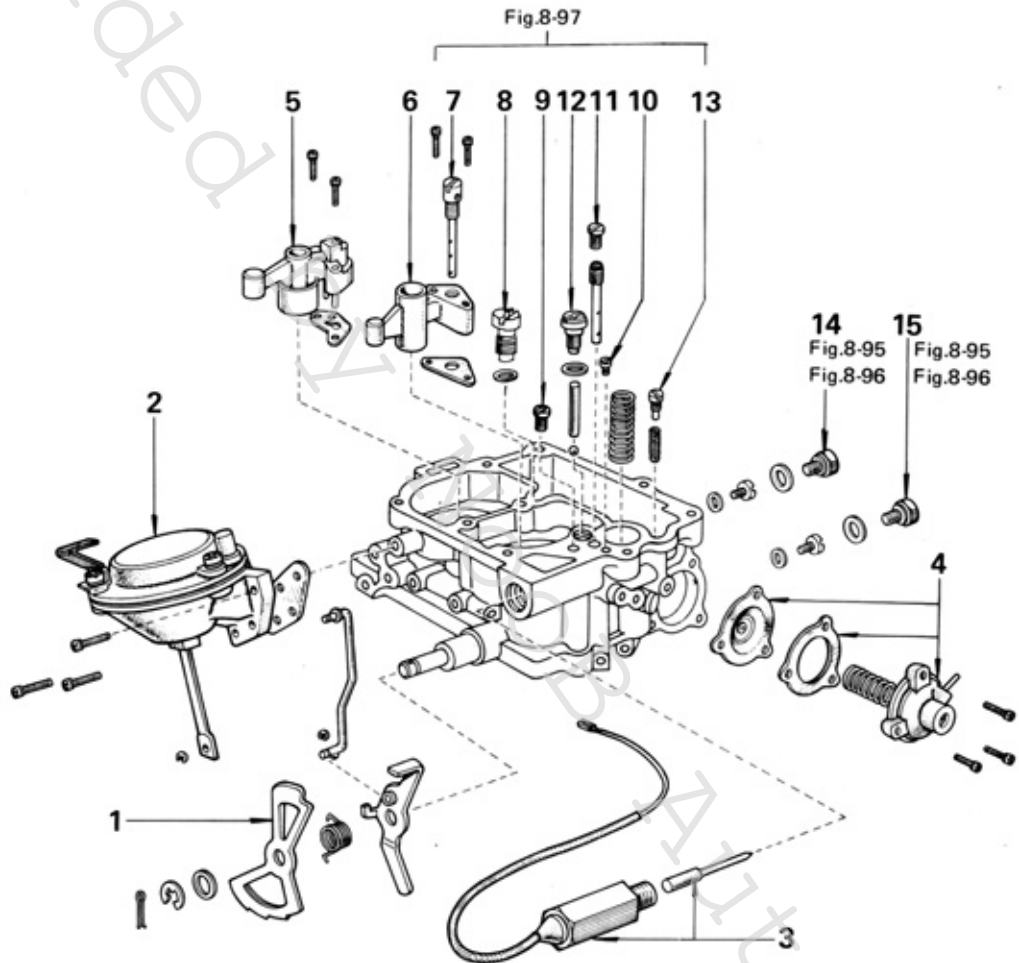
Tighten bolt and nut.

Fig. 8-93

Tighten bolt.

Body

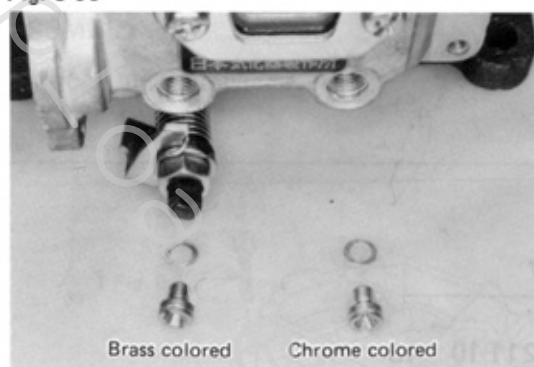
Assemble in numerical order.

Fig. 8-94

- 1 Fast Idle Cam
- 2 Second Throttle Valve Cam
- 3 Solenoid Valve
- 4 AAP Diaphragm
- 5 Second Small Venturi
- 6 First Small Venturi
- 7 Main Air Bleed
- 8 Power Jet

- 9 Second Air Bleed Jet
- 10 First Air Bleed Jet
- 11 Slow Jet
- 12 Pump Discharge Weight & Outlet Valve
- 13 AAP Outlet Valve
- 14 Second Main Jet
- 15 First Main Jet

Fig. 8-95



Install main jets over gasket.

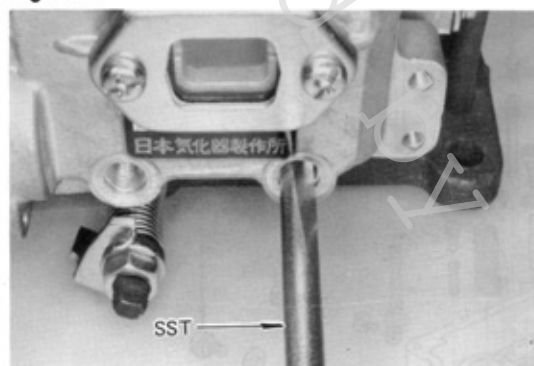
First jet

Brass colored

Second jet

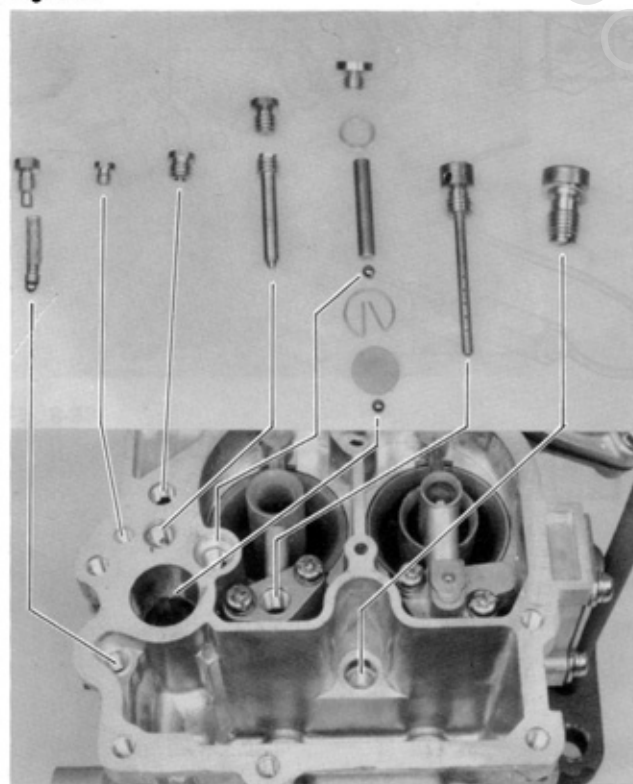
Chrome colored

Fig. 8-96



Tighten first and second main jets with SST [09860-11011].

Fig. 8-97



Install jets, air bleed, valve and plugs as shown.

Air Horn

Assemble in numerical order.

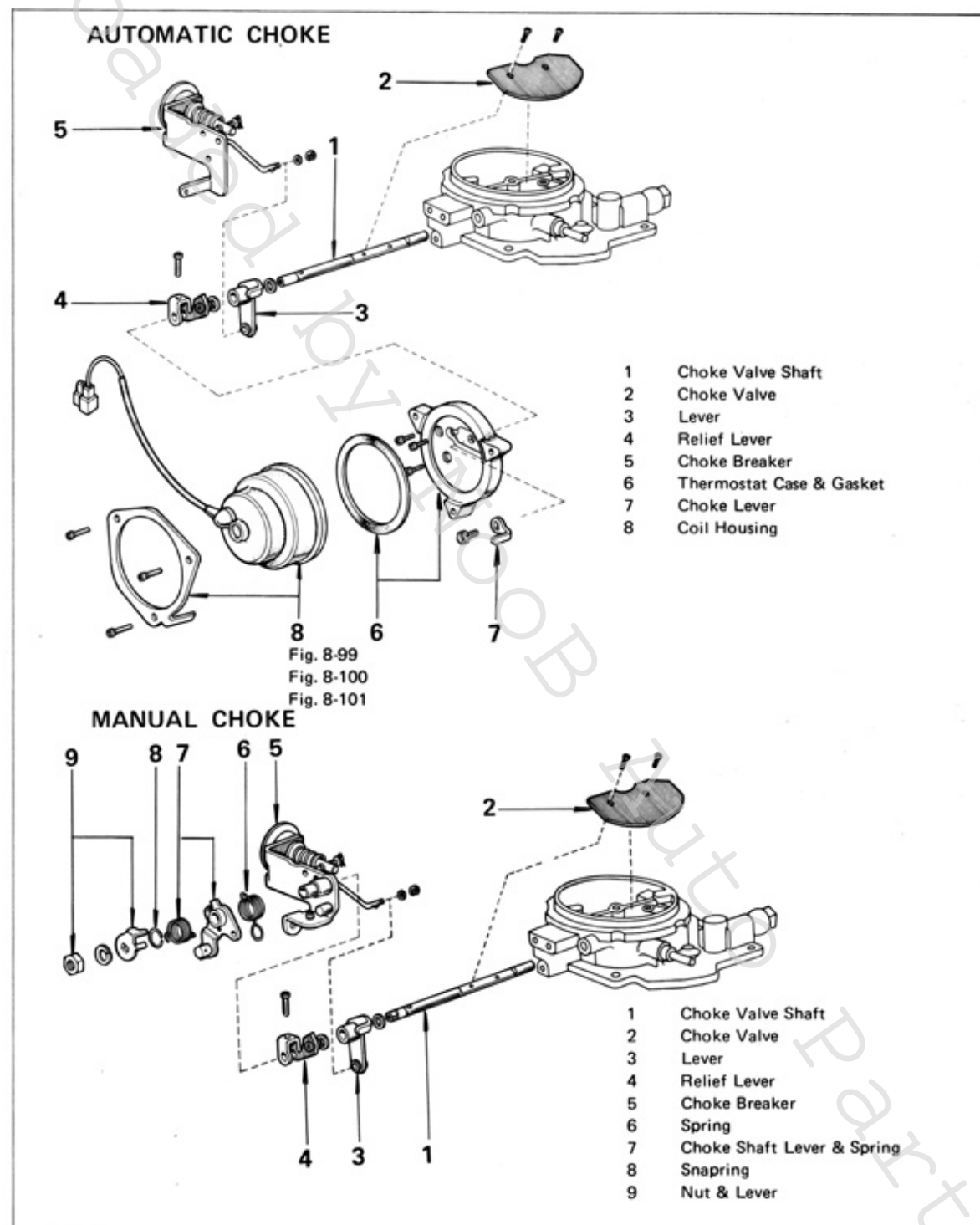
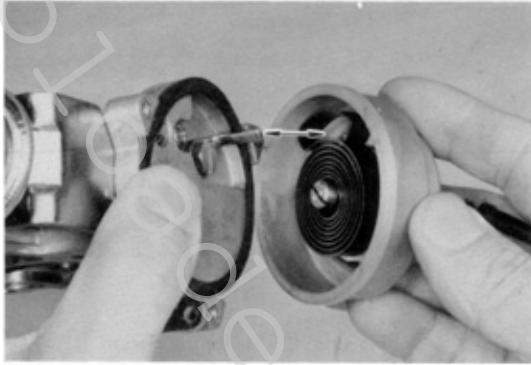
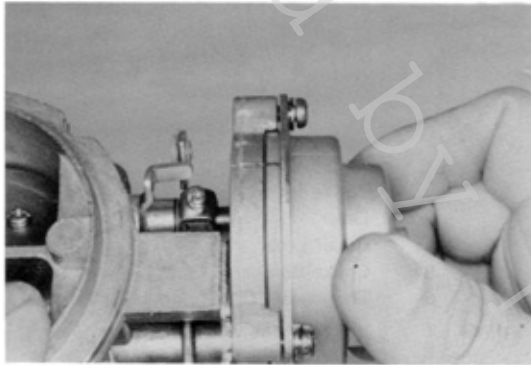
Fig. 8-98

Fig. 8-99



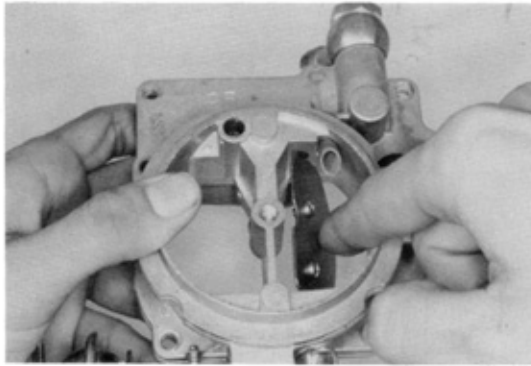
Hook lever to bimetal spring.

Fig. 8-100



Align case scale standard line against housing scale line.

Fig. 8-101



Check choke valve action.

Float

Assemble in numerical order.

Fig. 8-102

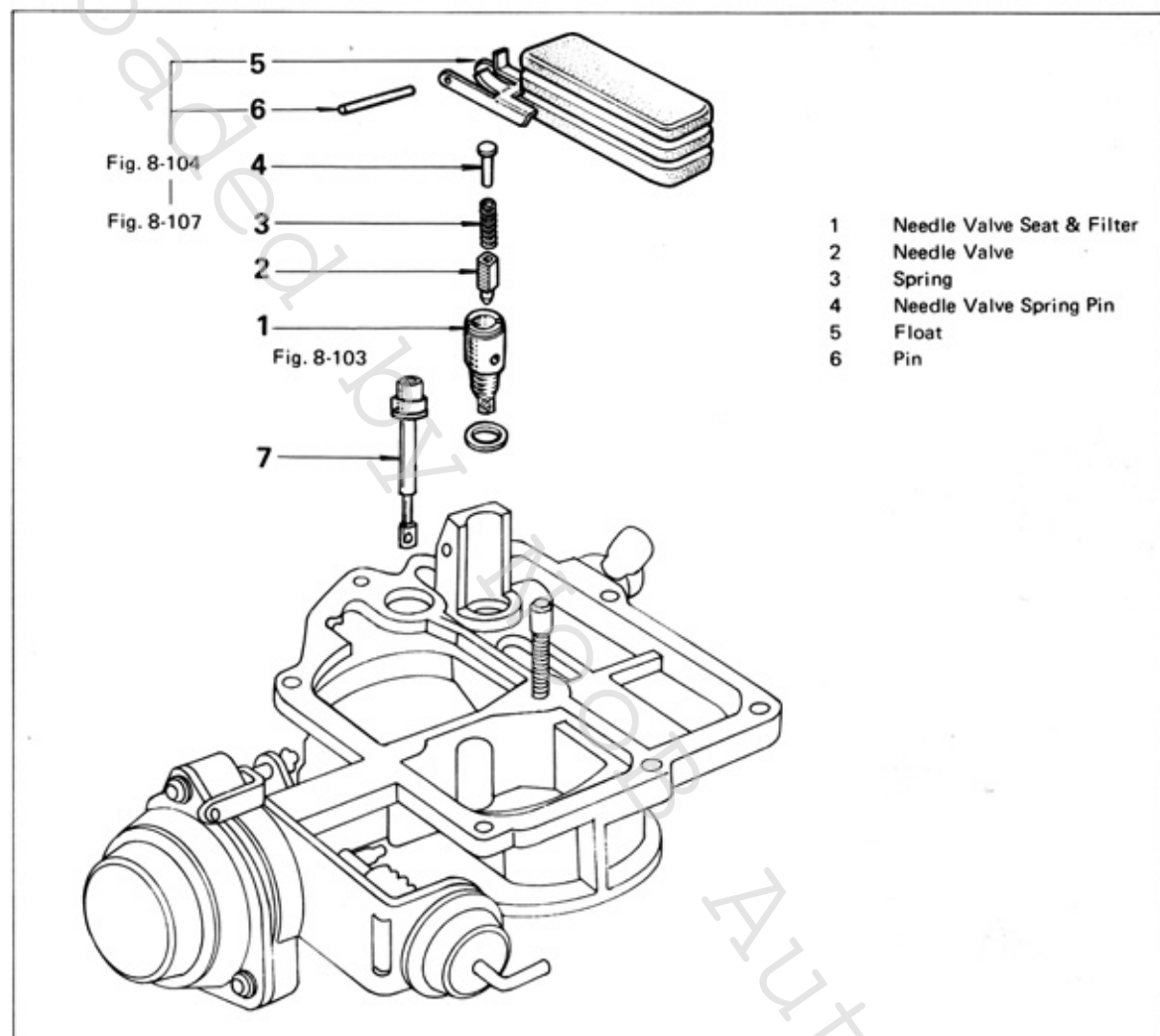
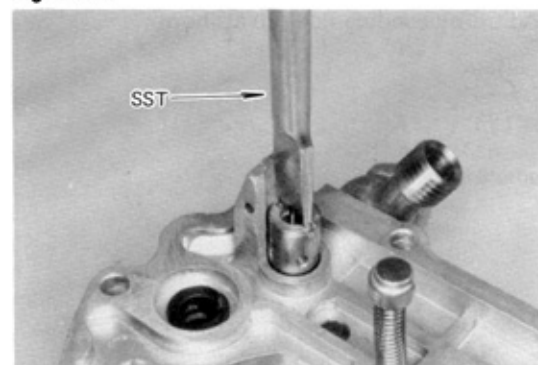
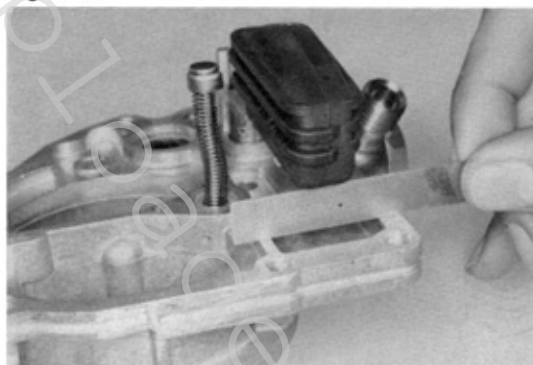


Fig. 8-103



Tighten needle valve seat with SST [09860-11011].

Fig. 8-104



Adjust float level.

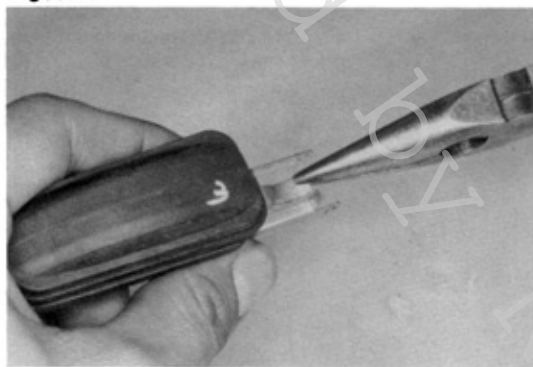
Allow the float to hang down by its own weight. Then check the clearance between the float tip and air horn with SST [09240-00014]. Adjust by bending the (A) part of float lip.

| | |
|-----------------|-------------------------|
| Standard | 10.0 – 11.0 mm |
| | (0.39 – 0.43 in) |

— Note —

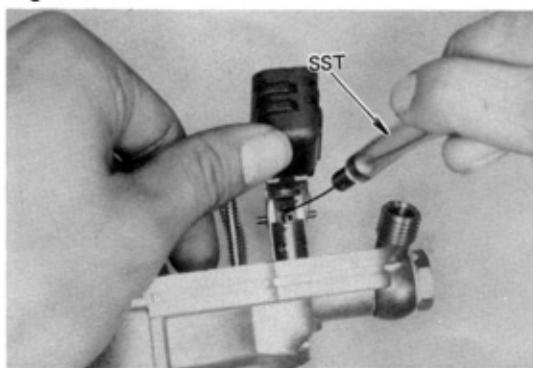
This measurement is always made without any gasket on air horn.

Fig. 8-105



Adjust by bending float lip as shown.

Fig. 8-106



Adjust lowered position.

Lift up the float and check the clearance between the needle valve plunger and float lip with SST [09240-00020]. Adjust by bending the (B) part of float lip.

| | |
|-----------------|---------------------------|
| Standard | 1.0 – 1.2 mm |
| | (0.039 – 0.047 in) |

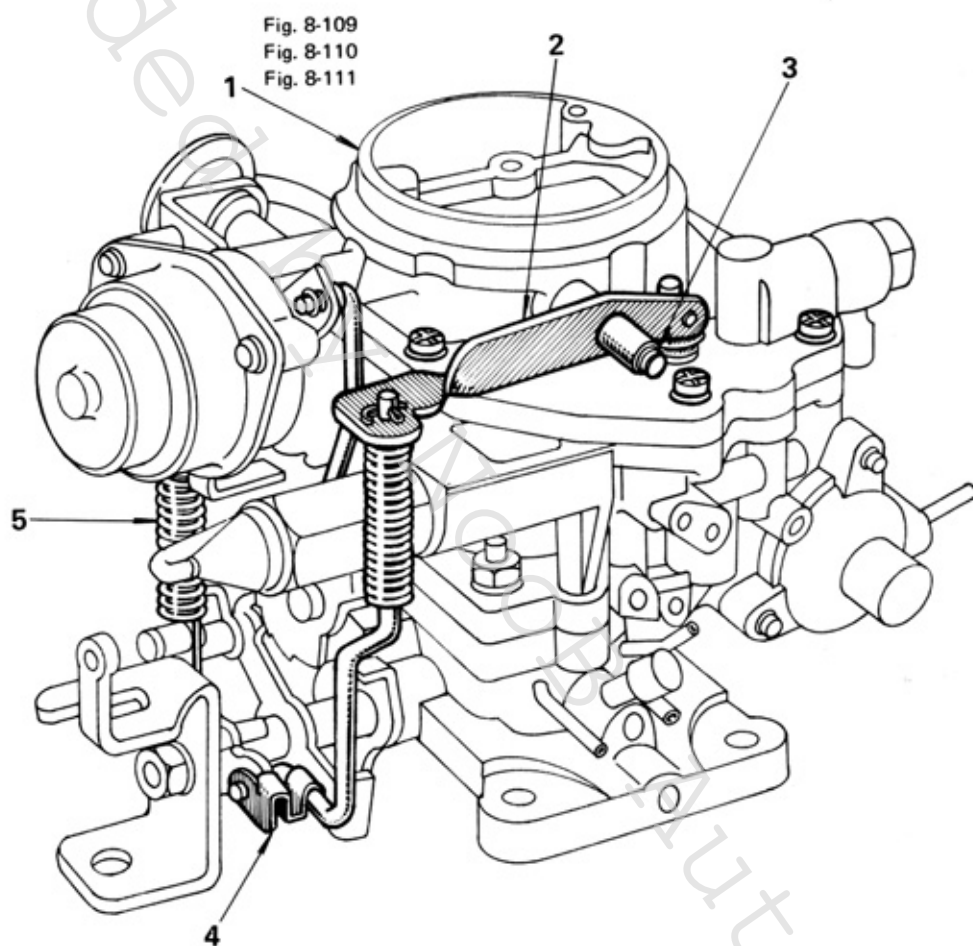
Fig. 8-107



Adjust by bending float lip as shown.

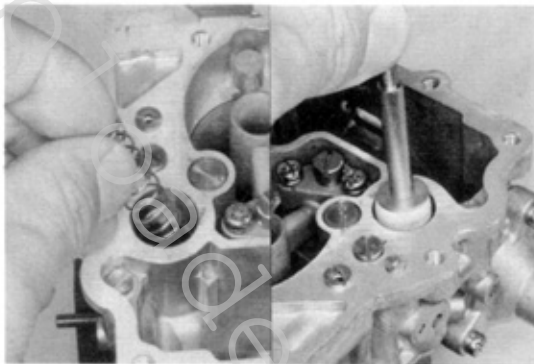
Body And Air Horn

Assemble in numerical order.

Fig. 8-108

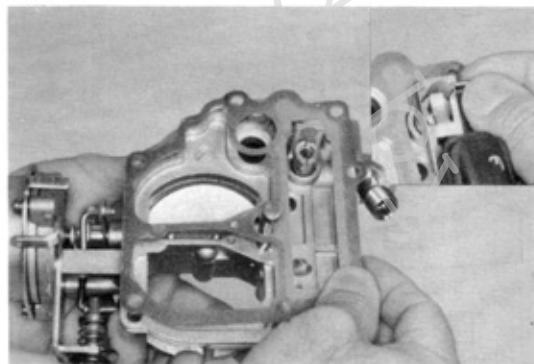
- 1 Air Horn
- 2 Pump Lever & Connecting Rod
- 3 "E" Washer
- 4 Clip
- 5 Throttle Lever Return Spring

Fig. 8-109



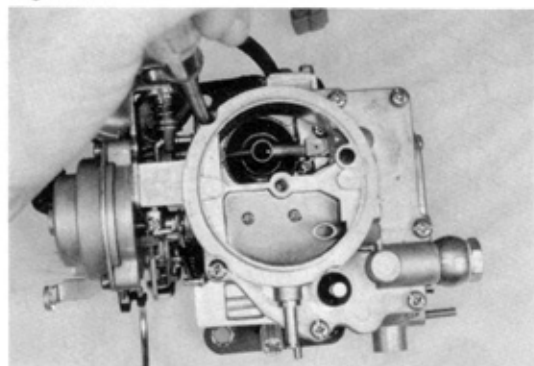
Before assembling air horn, pump damping spring and plunger.

Fig. 8-110



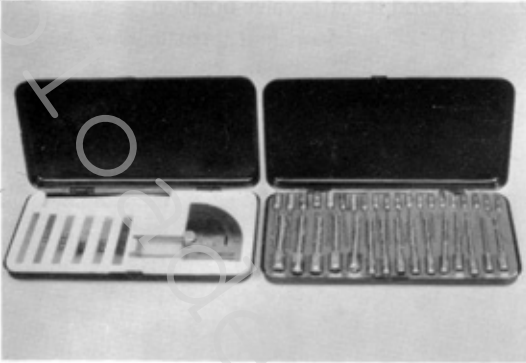
Put on gasket on air horn and install needle valve and float.

Fig. 8-111



Gradually tighten air horn set screw in 2 or 3 stages in diagonal order.

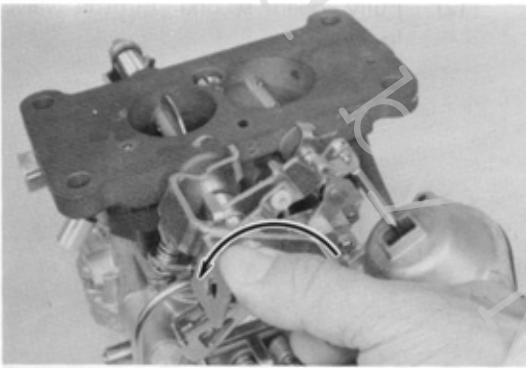
Fig. 8-112

**ADJUSTMENT**

Use SST [09240-00014 and 09240-00020] to make adjustments.

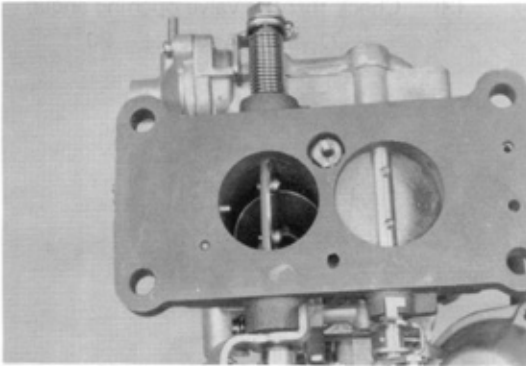


Fig. 8-113



1. First throttle valve opening.
 - (1) Fully open first throttle valve.

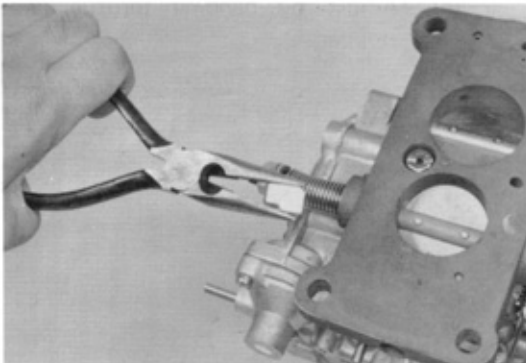
Fig. 8-114



- (2) Check first throttle valve opening angle.

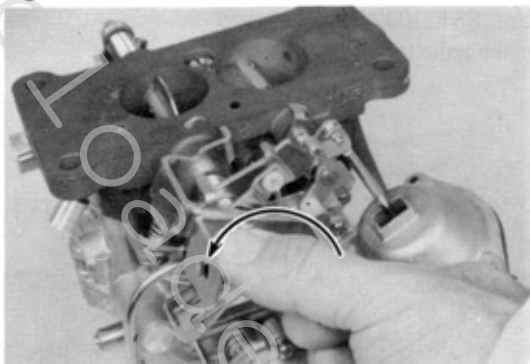
Opening Angle **90°**

Fig. 8-115



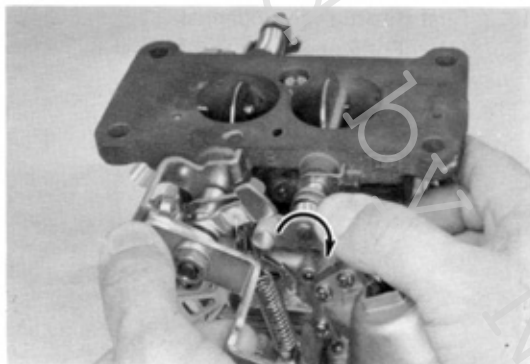
- (3) Adjust by bending throttle lever stopper.

Fig. 8-116



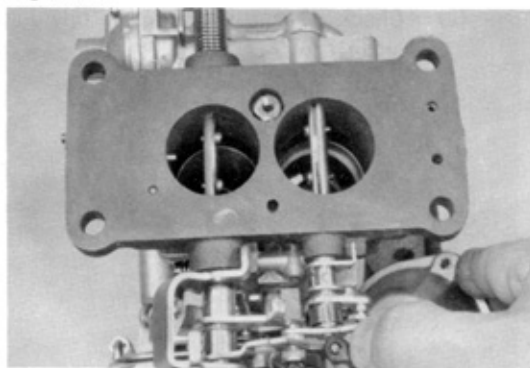
2. Second throttle valve opening
(1) Fully open first throttle valve.

Fig. 8-117



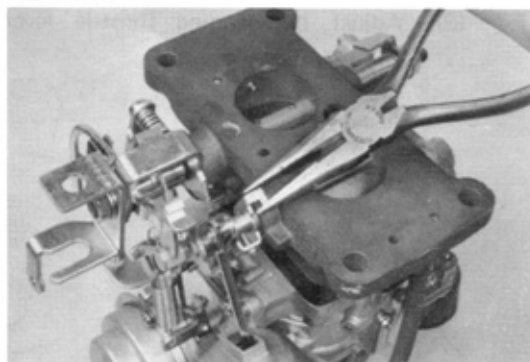
- (2) Fully open second throttle valve lever.

Fig. 8-118



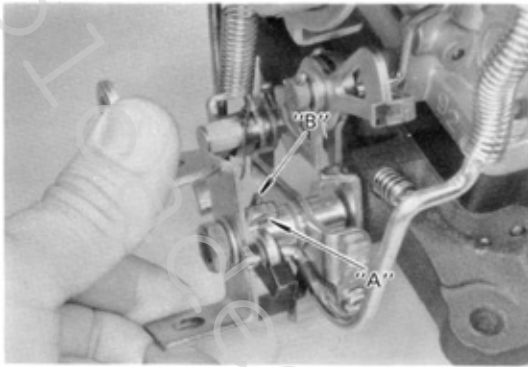
- (3) Check throttle valve opening angle.
Opening Angle 90°

Fig. 8-119



- (4) Adjust by bending throttle lever stopper.

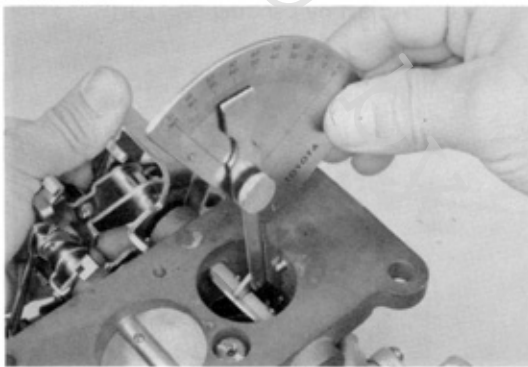
Fig. 8-120



3. Seco-touch angle.

- (1) Open first throttle valve until throttle valve lever "A" part touch "B" part.

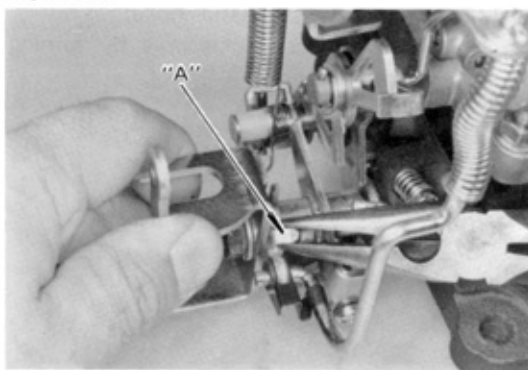
Fig. 8-121



- (2) At this time, check first throttle valve opening angle.

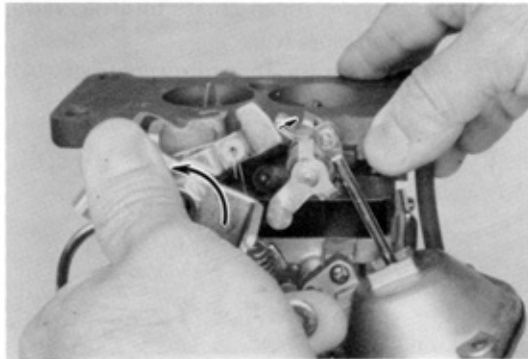
Seco-touch Angle 57 – 61°

Fig. 8-122



- (3) Adjust by bending "A" part.

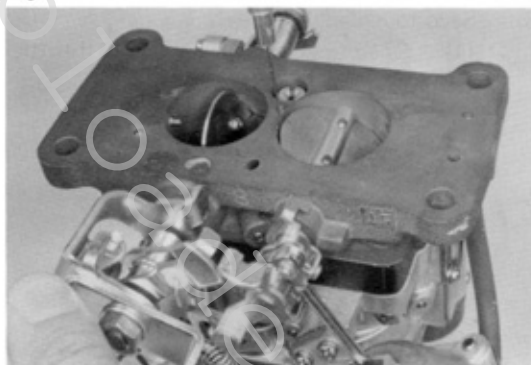
Fig. 8-123



4. Kick up

- (1) Open first throttle valve until kick arm slightly open second throttle valve.

Fig. 8-124



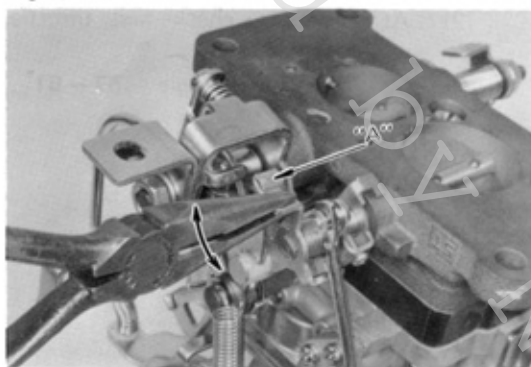
- (2) Check clearance between second throttle valve and body.

Kick up clearance

0.1 – 0.3 mm

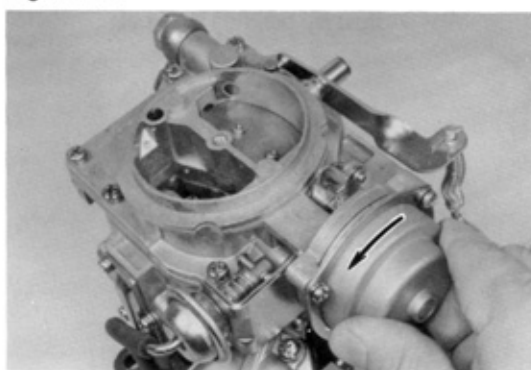
(0.004 – 0.012 in)

Fig. 8-125



- (3) Adjust by bending "A" part.

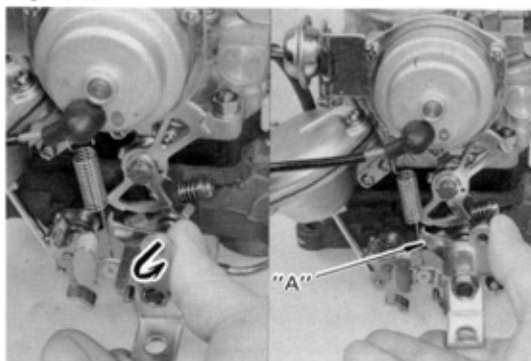
Fig. 8-126



5-1. Fast idle (only automatic choke)

- (1) Fully close choke valve by turning coil housing.

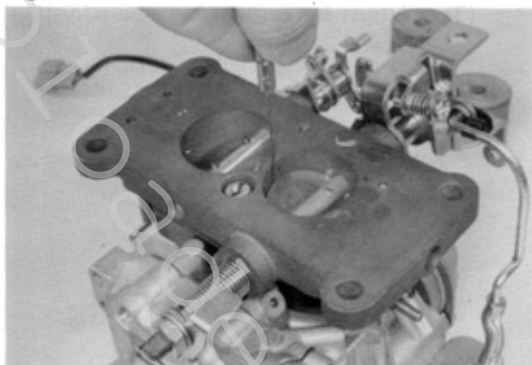
Fig. 8-127



- (2) Slightly open first throttle valve, then close it.

Make sure that throttle lever "A" part hook fast idle cam.

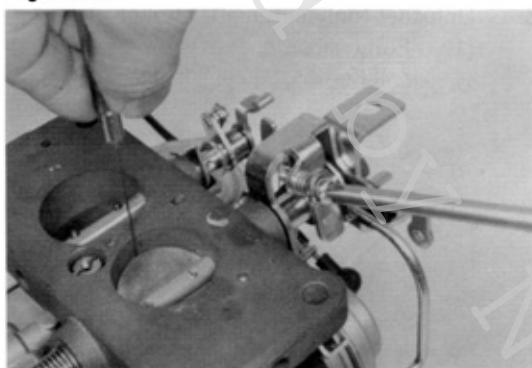
Fig. 8-128



- (3) Check clearance between first throttle valve and bore.

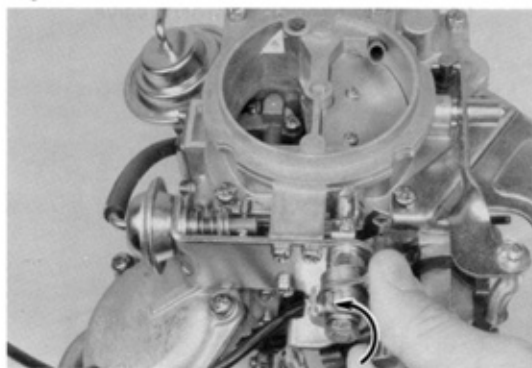
Fast idle clearance
0.81 mm (0.032 in.)

Fig. 8-129



- (4) Adjust by turning fast idle adjusting screw.

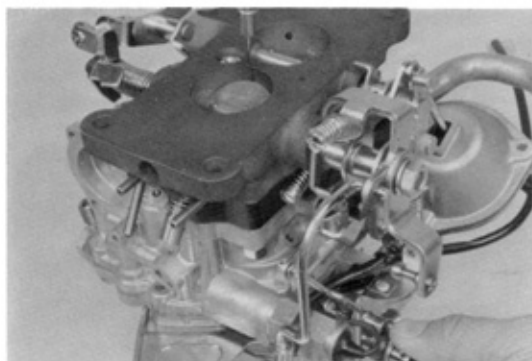
Fig. 8-130



5-2. Fast idle (only manual choke)

- (1) Fully close choke valve by turning choke shaft lever.

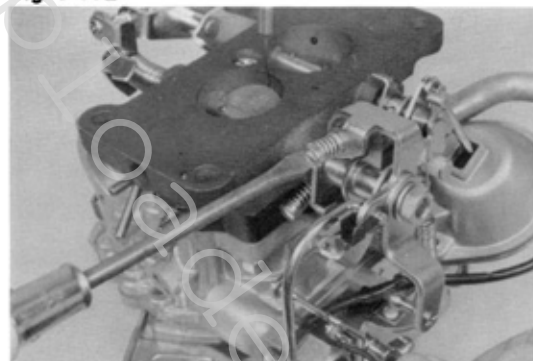
Fig. 8-131



- (2) Check clearance between first throttle valve and bore.

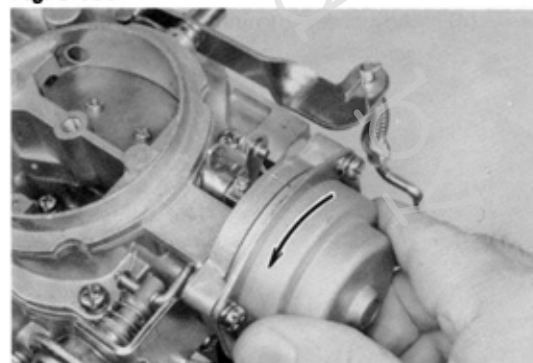
Fast idle clearance
1.01 mm (0.039 in)

Fig. 8-132



- (3) Adjust by turning fast idle adjusting screw.

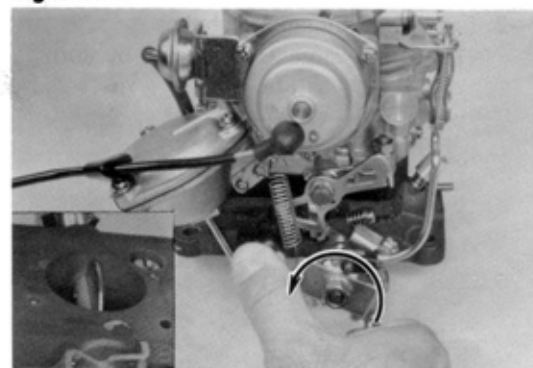
Fig. 8-133



6. Unloader (only automatic choke)

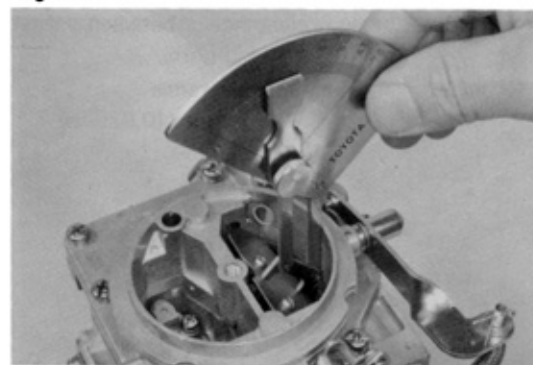
- (1) Fully close choke valve by turning coil housing.

Fig. 8-134



- (2) Fully open first throttle valve.

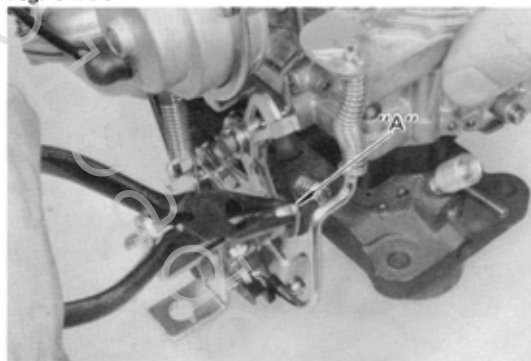
Fig. 8-135



- (3) At this time, check choke valve opening angle.

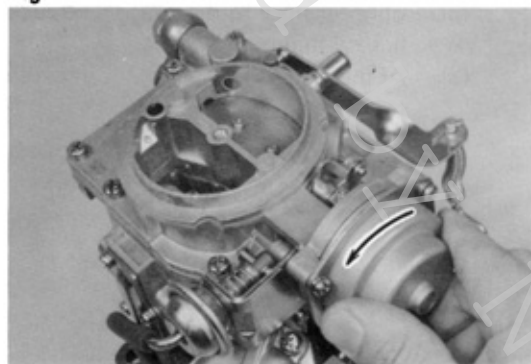
Unloader Angle 50°

Fig. 8-136



- (4) Adjust by bending "A" part.

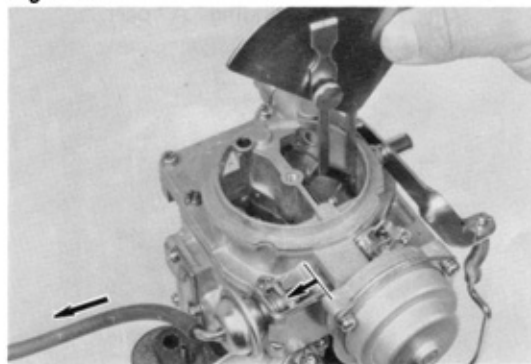
Fig. 8-137



7-1. Choke breaker (only automatic choke)

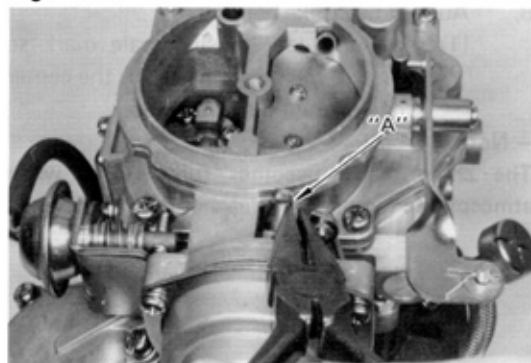
- (1) Fully close choke valve by turning coil housing.

Fig. 8-138



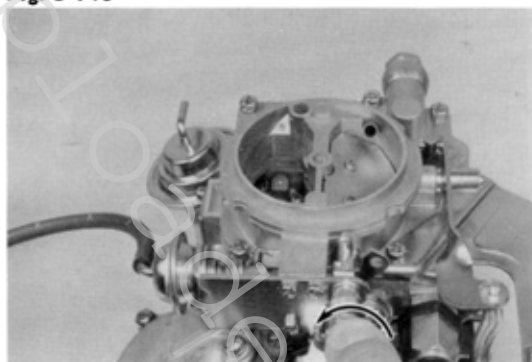
- (2) Connect hose to diaphragm and suck hose with mouth.
(3) At this time, check clearance between choke valve and bore.

Fig. 8-139



- (4) Adjust by bending "A" part.

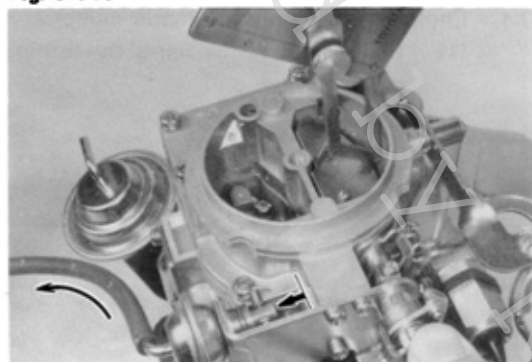
Fig. 8-140



7-2. Choke breaker (only manual choke)

- (1) Fully close chock valve by turning choke lever.

Fig. 8-141



- (2) Connect hose to diaphragm and suck hose with mouth.
- (3) At this time, check clearance between choke lever, and bore.

Fig. 8-142



- (4) Adjust by bending "A" part.

Fig. 8-143



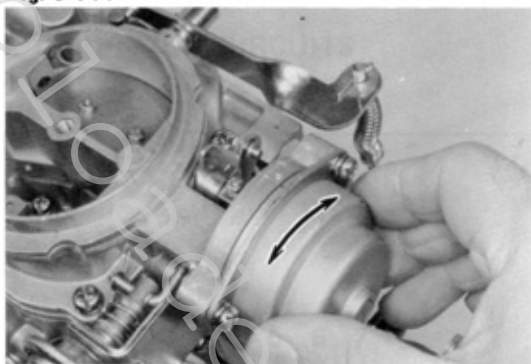
8. Automatic choke

- (1) Set the coil housing scale mark so that it will be aligned with the center line of the thermostat case.

— Note —

The choke valve becomes fully closed when atmospheric temperature reaches 25°C (77°F).

Fig. 8-144

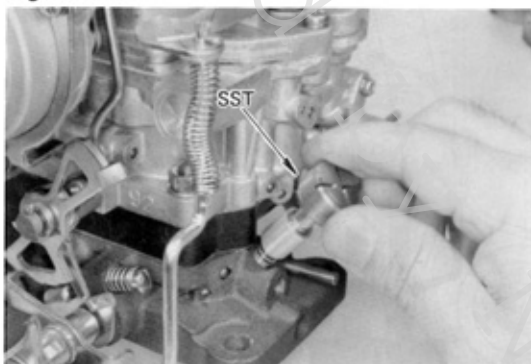


- (2) Depending on the vehicle operating conditions, turn the coil housing and adjust the engine starting mixture.

If too rich Turn clock-wise.

If too lean ... Turn counterclock-wise.

Fig. 8-145



9. Idle mixture adjusting screw.
Screw in the idle mixture adjusting screw and then unscrew it by the following amount.

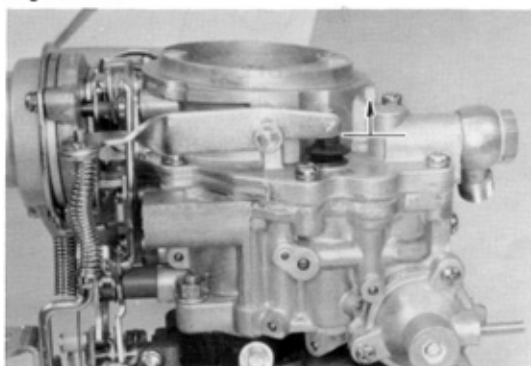
Standard (Reference only)

Returned about 3 turns from full closed

— Caution —

Take care not to screw in too tightly and damage the screw tip.

Fig. 8-146



10. Accelerating pump
Adjust the pump stroke by bending part (A).

Standard 4.0 mm (0.16 in)

— Note —

After adjustment is made, be sure to check the linkage to see that it operates smoothly.

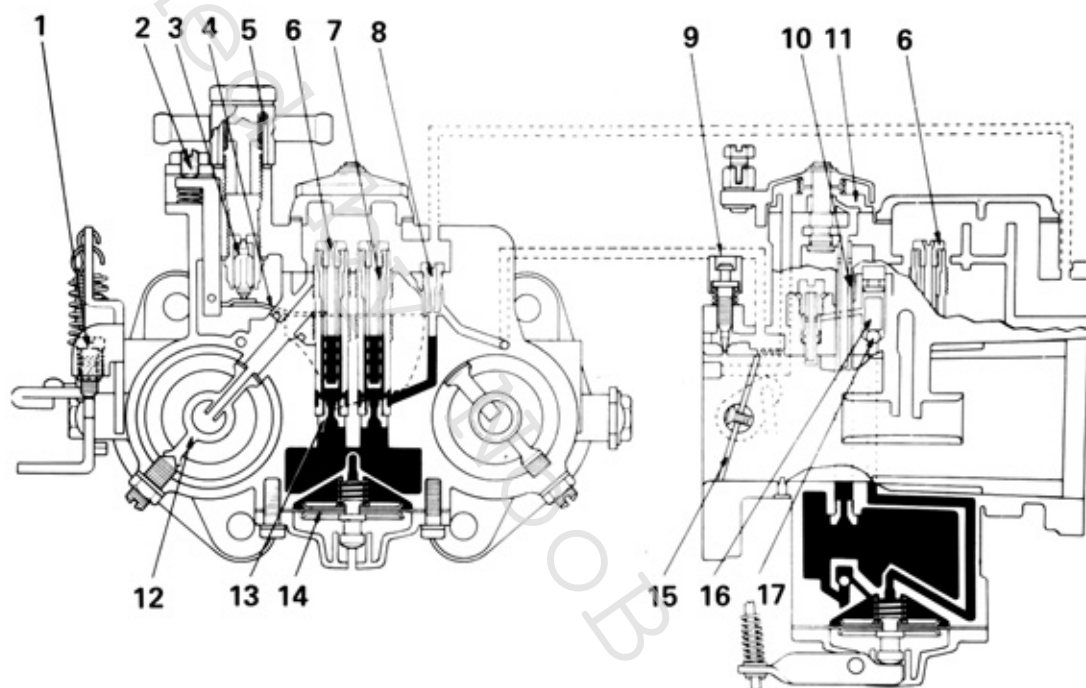
MEMO

Uploaded by Noob Auto Parts

CARBURETOR(FOR 18R-G ENGINE)

CARBURETOR CIRCUITS

Fig. 8-150



- 1 Idle Speed Adjusting Screw
- 2 Screw (For Float Adjustment)
- 3 Needle Valve Sub-assembly
- 4 Float Sub-assembly
- 5 Strainer
- 6 Main Air Bleed Jet
- 7 Main Air Bleed Tube
- 8 Slow Jet
- 9 Idle Mixture Adjusting Screw

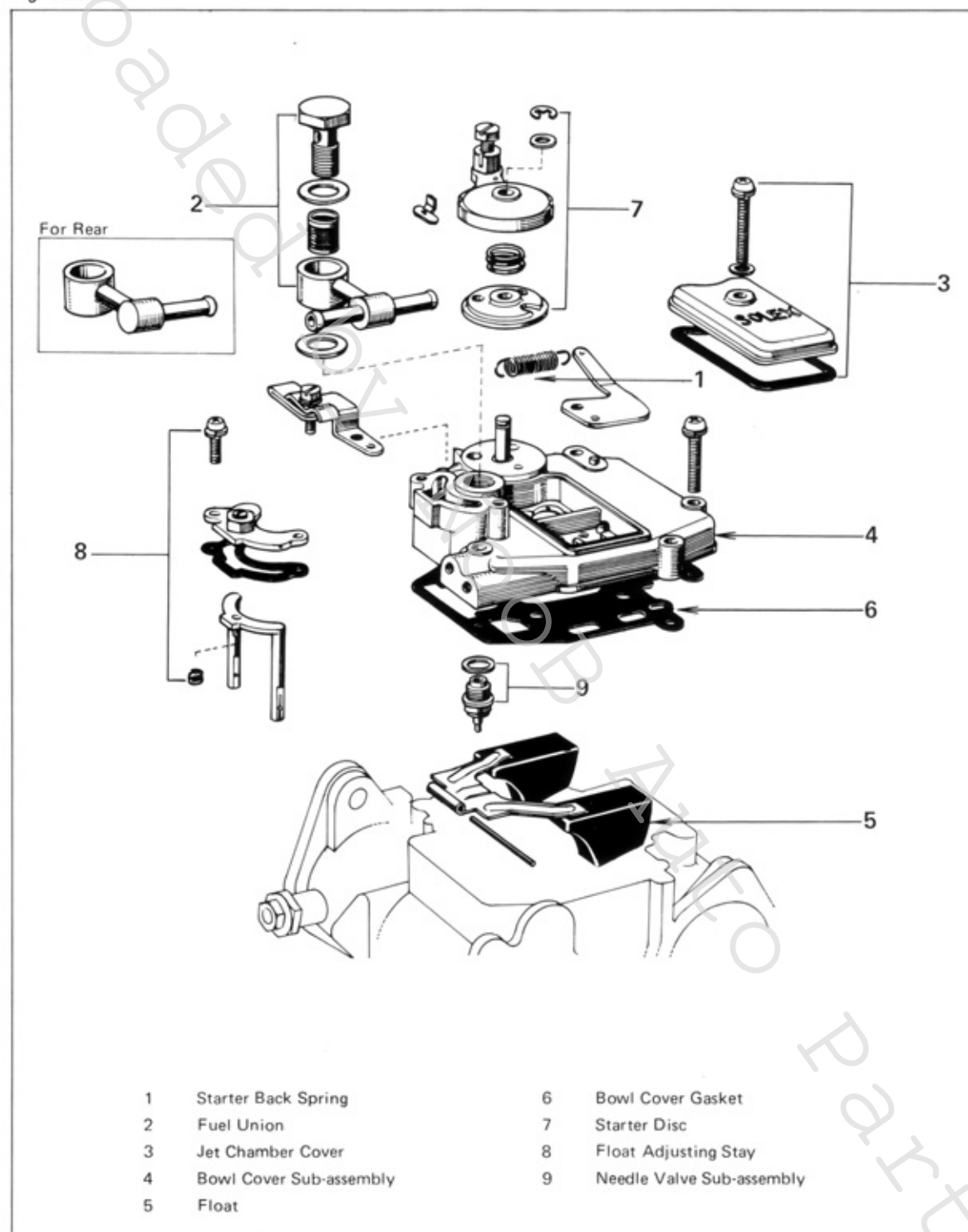
- 10 Air Bleed Tube
- 11 Starter Disc
- 12 Inner Venturi
- 13 Main Jet
- 14 Diaphragm Rod Sub-assembly
- 15 Throttle Valve
- 16 Pump Valve Weight
- 17 Pump Valve Check Ball

DISASSEMBLY

Bowl Cover

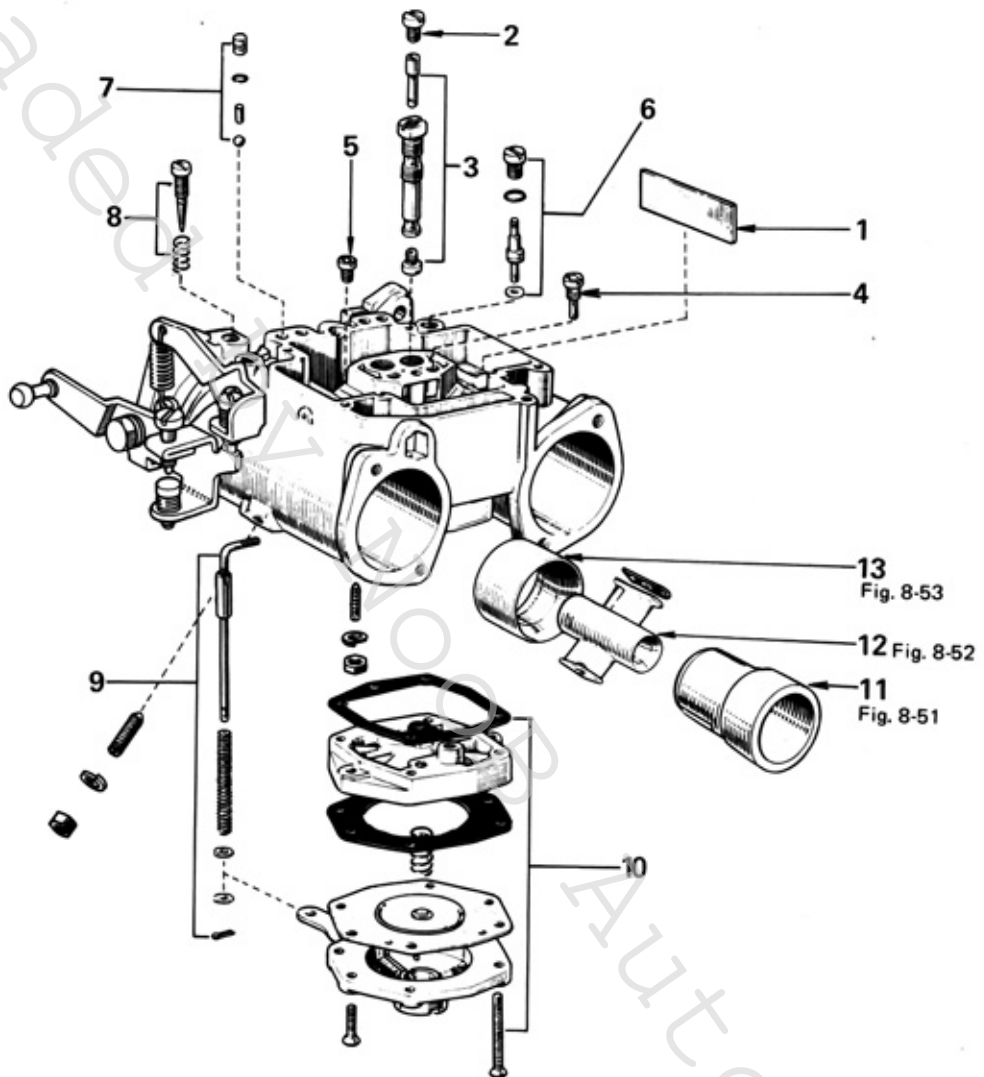
Disassemble in numerical order.

Fig. 8-151



Body

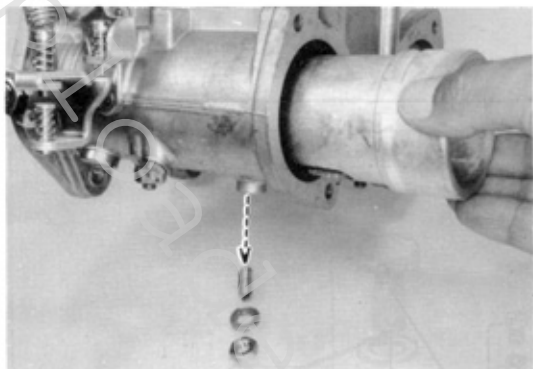
Disassemble in numerical order.

Fig. 8-152

- 1 Float Chamber Plate
- 2 Main Air Bleed Jet
- 3 Main Jet Holder
- 4 Slow Jet
- 5 Starter Jet
- 6 Pump Nozzle
- 7 Pump Check Valve

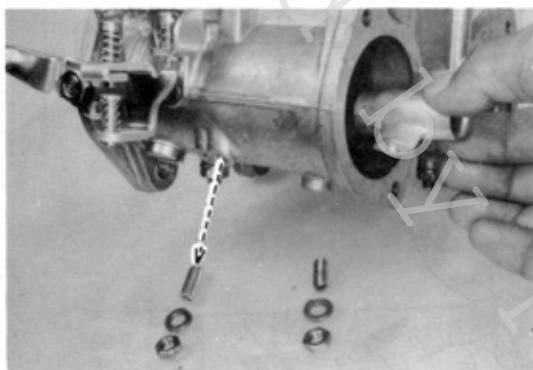
- 8 Idle Mixture Adjusting Screw
- 9 Pump Rod
- 10 Accelerating Pump
- 11 Sleeve
- 12 Small Venturi
- 13 Large Venturi

Fig. 8-153



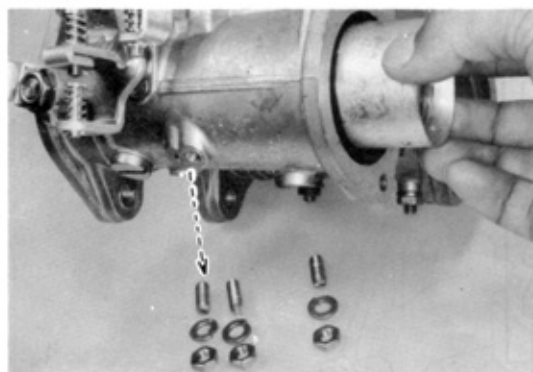
Remove the set screw and take out the sleeve.

Fig. 8-154



Remove the set screw and take out the small venturi.

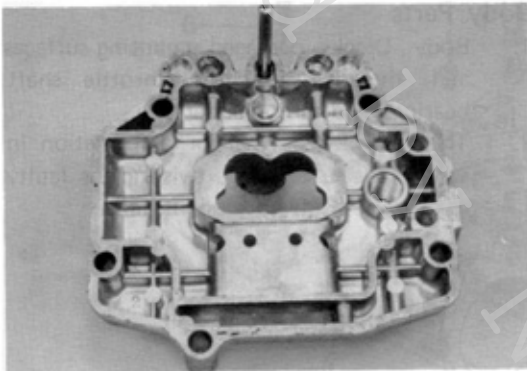
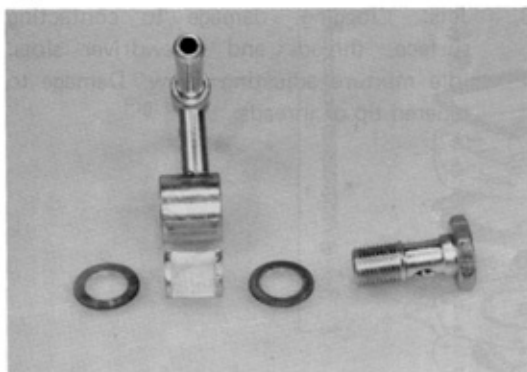
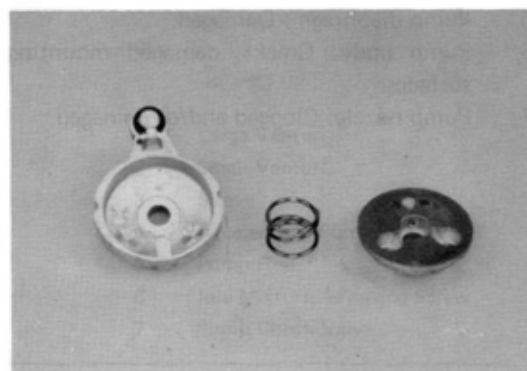
Fig. 8-155



Remove the set screw and take out the large venturi.

INSPECTION**— Precaution —**

1. Before inspecting the parts, wash them thoroughly in gasoline. Using compressed air, blow all dirt and other foreign matter from the jets and similar parts, and from the fuel passages and apertures in the body.
2. Never clean the jets or orifices with wire or a drill. This could enlarge the openings and result in excessive fuel consumption.

Fig. 8-156**Fig. 8-157****Fig. 8-158**

Inspect the following parts and replace any part damaged.

Bowl Cover Parts

1. Bowl cover: Cracks, damaged threads.
2. Starter pipe: Damaged and/or clogged.



3. Filter: Clogged, rusted, or damaged.

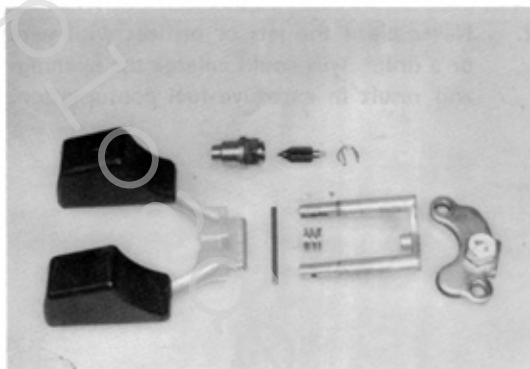
— Note —

New gasket must always be used whenever the union is removed.



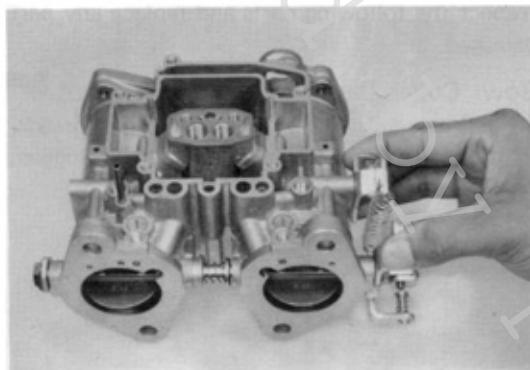
4. Starter disc: Damaged or worn sliding surface.

Fig. 8-159



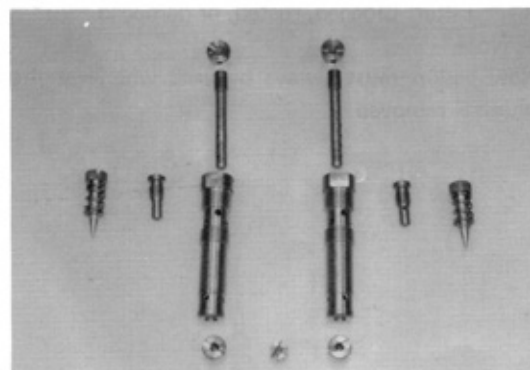
5. Needle valve: Contacting valve seat.
6. Float: Deformed, wear in float lever pin holes, bent float arms.

Fig. 8-160

**Body Parts**

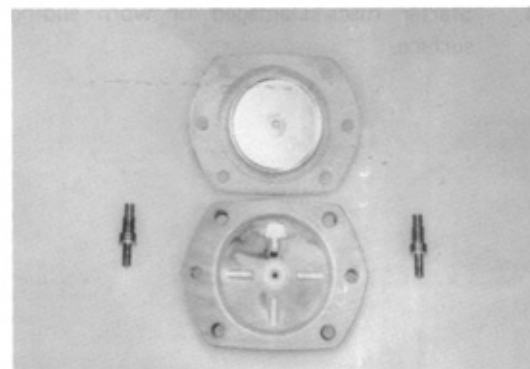
1. Body: Cracks, damaged mounting surfaces and threads, wear on throttle shaft bearings, and carbon adherence.
2. Throttle valves: Wear or deformation in valves. Wear, bending, twisting, or faulty movement inside housing of shaft.

Fig. 8-161



3. Jets: Clogging, damage to contacting surface, threads and screwdriver slots.
4. Idle mixture adjusting screw: Damage to tapered tip or threads.

Fig. 8-162



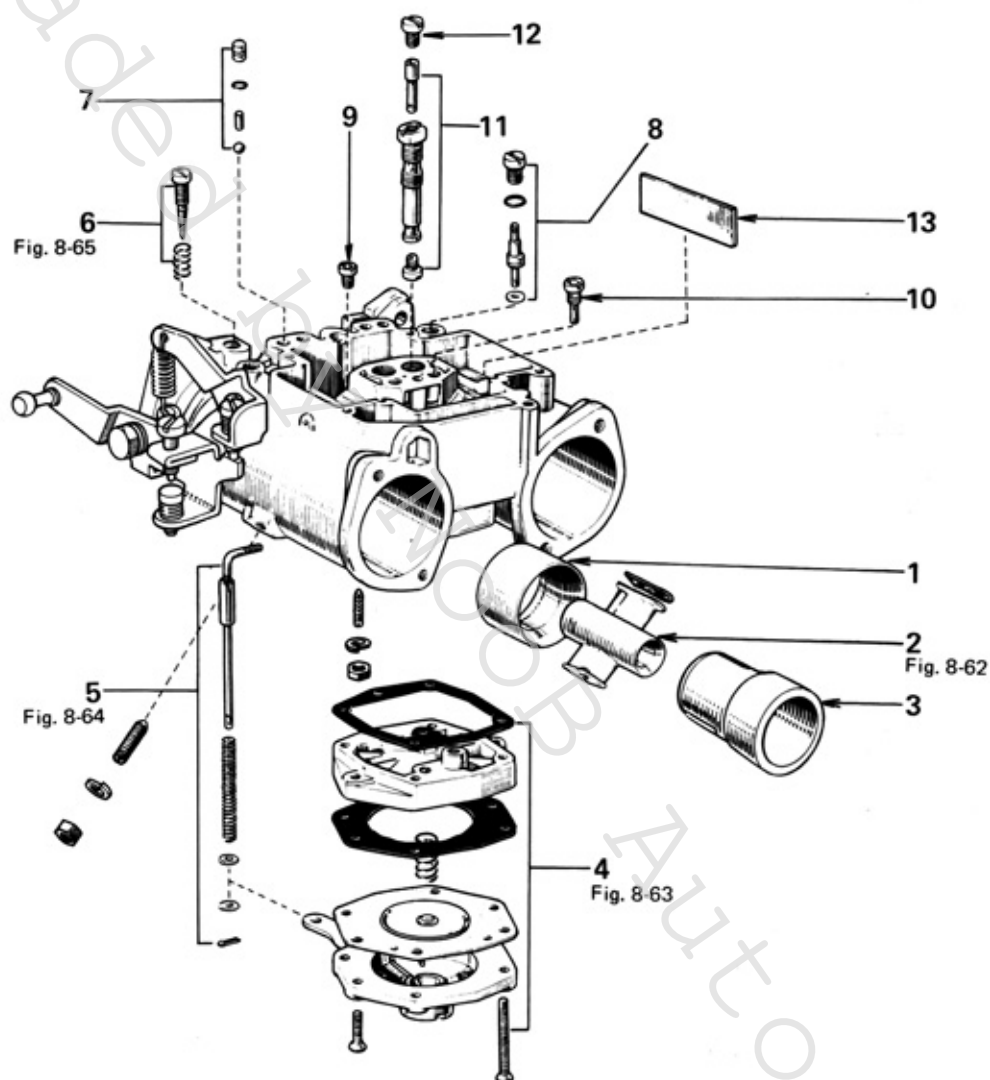
5. Pump diaphragm: Damaged.
6. Pump body: Cracks, damaged mounting surfaces.
7. Pump nozzle: Clogged and/or damaged.

ASSEMBLY

Body

Assemble in numerical order.

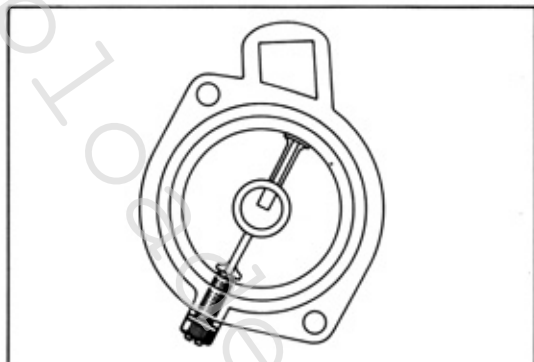
Fig. 8-163



- 1 Large Venturi
- 2 Small Venturi
- 3 Sleeve
- 4 Accelerating Pump
- 5 Pump Rod
- 6 Idle Mixture Adjusting Screw
- 7 Pump Check Valve

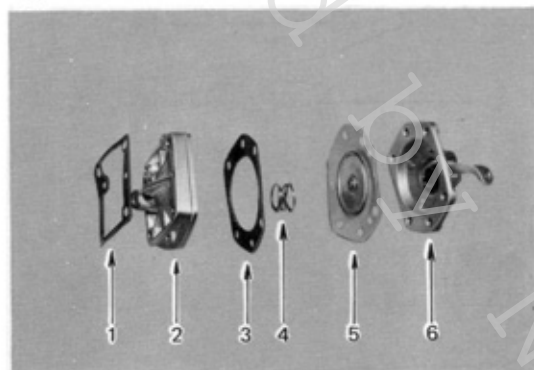
- 8 Pump Nozzle
- 9 Starter Jet
- 10 Slow Jet
- 11 Main Jet Holder
- 12 Main Air Bleed Jet
- 13 Float Chamber Plate

Fig. 8-164



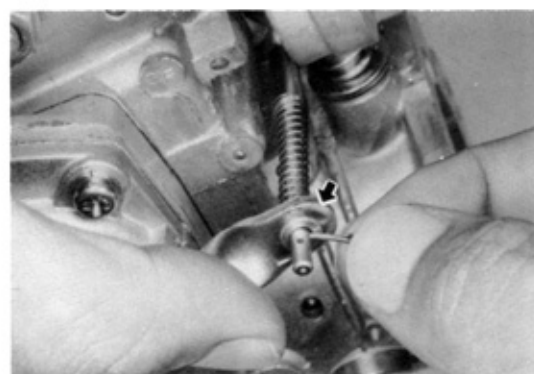
Using the longest screw, assemble the small venturi as shown.

Fig. 8-165



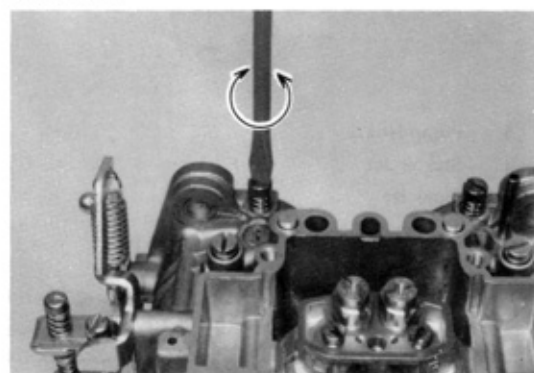
Assemble the accelerating pump in numerical order as shown.

Fig. 8-166



Install the cotter pin in the third hole from the tip of pump rod.

Fig. 8-167



Screw out $1\frac{1}{2}$ turn from fully closed position.
— Note —
Take care not to mistake the left and right sides.

Bowl Cover

Assemble in numerical order.

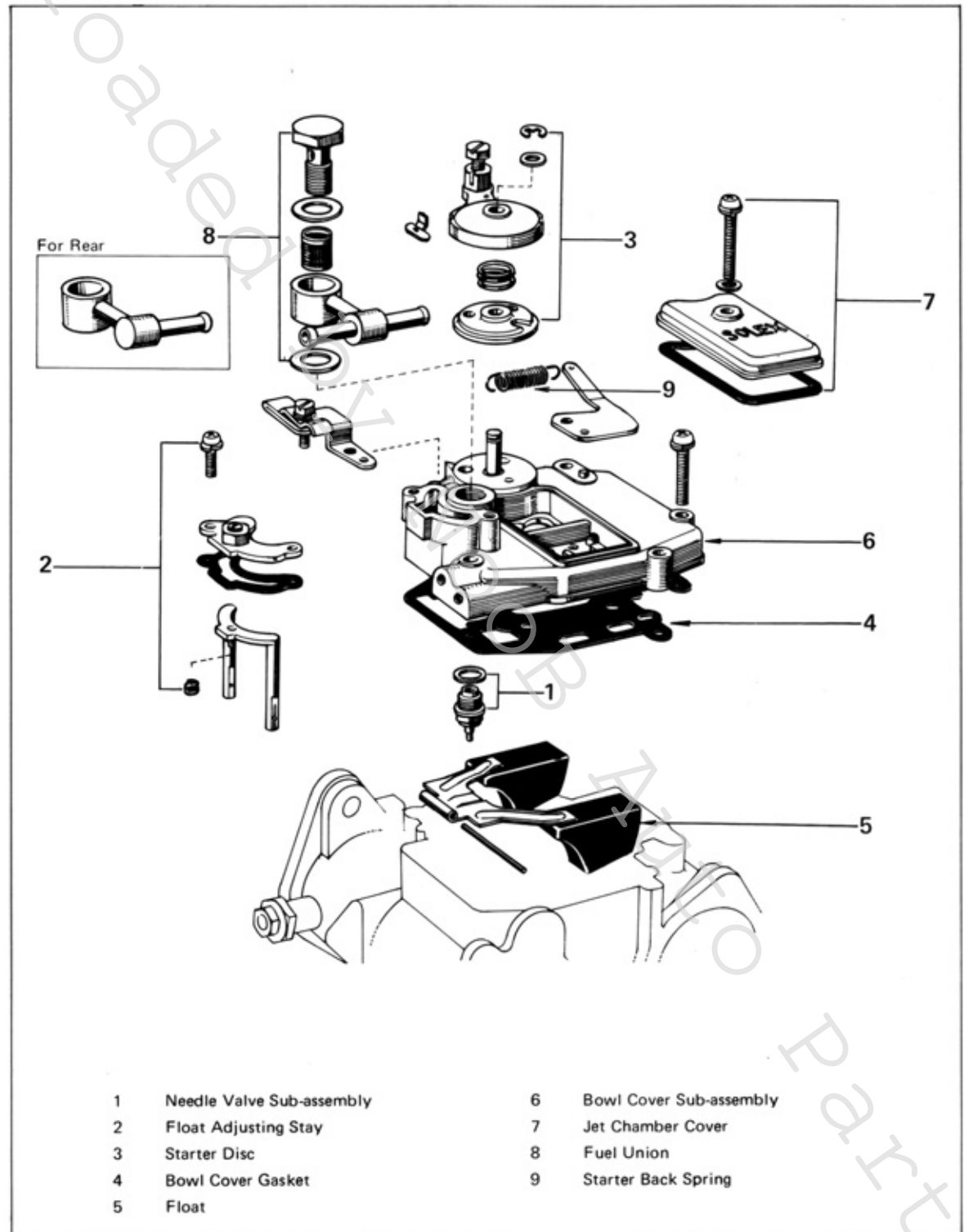
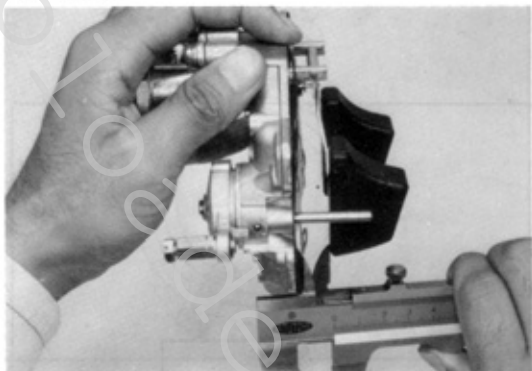
Fig. 8-168

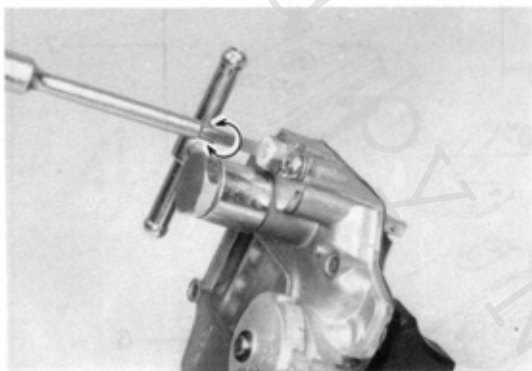
Fig. 8-170



Preset the float position.

About 16 mm (0.63 in) from bowl cover lower surface.

Fig. 8-169



Adjust the float position as shown, if necessary.

STARTING SYSTEM

| | Page |
|-------------------------------|--------|
| STARTING SYSTEM CIRCUIT | 9 – 2 |
| STARTER | |
| DISASSEMBLY | 9 – 3 |
| INSPECTION AND REPAIR | 9 – 6 |
| ASSEMBLY | 9 – 13 |
| PERFORMANCE TEST | 9 – 17 |

STARTING SYSTEM CIRCUIT

Fig. 9-1

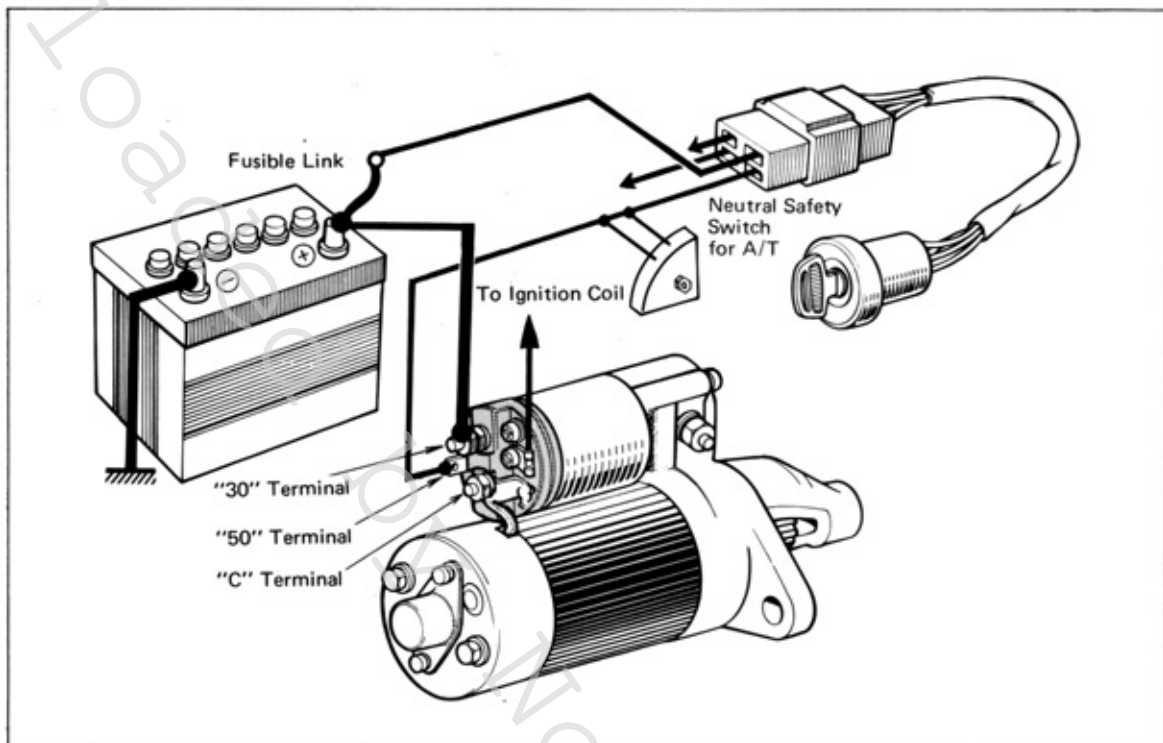
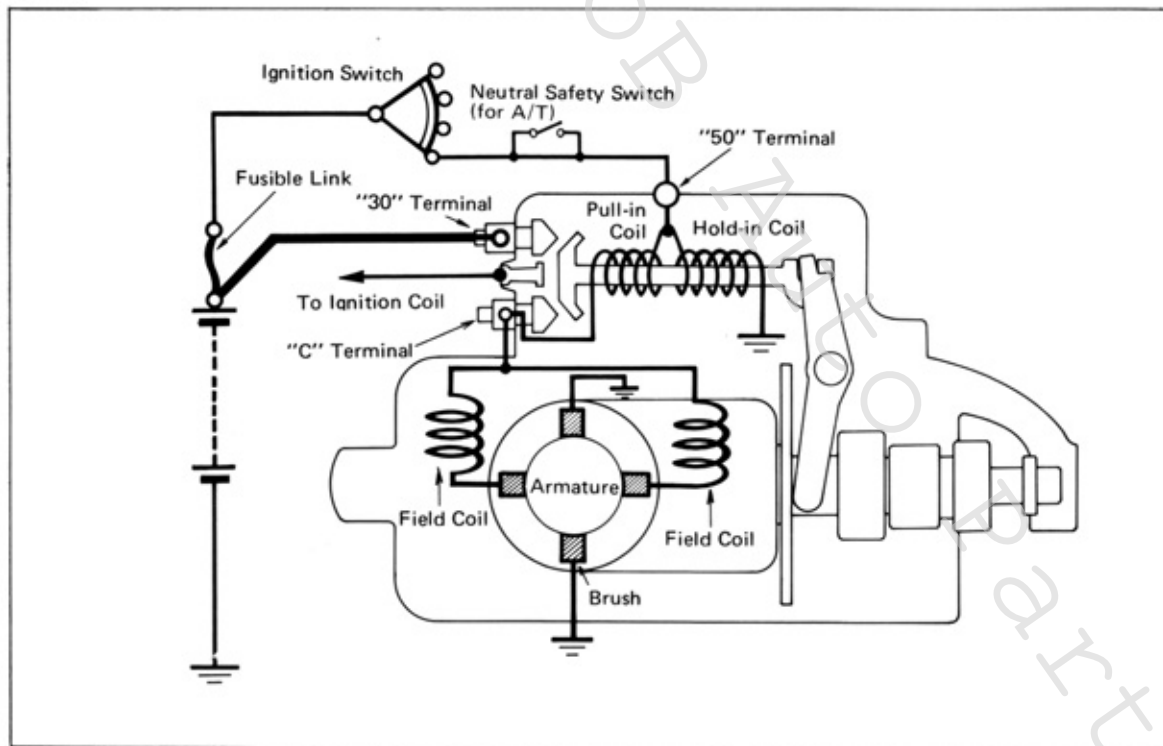


Fig. 9-2



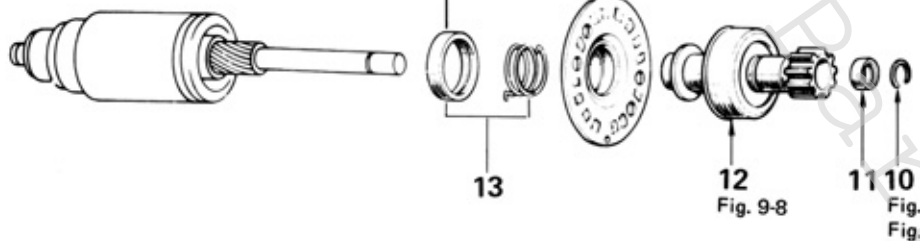
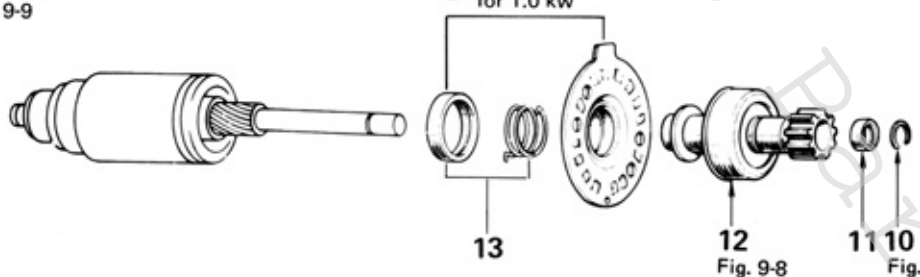
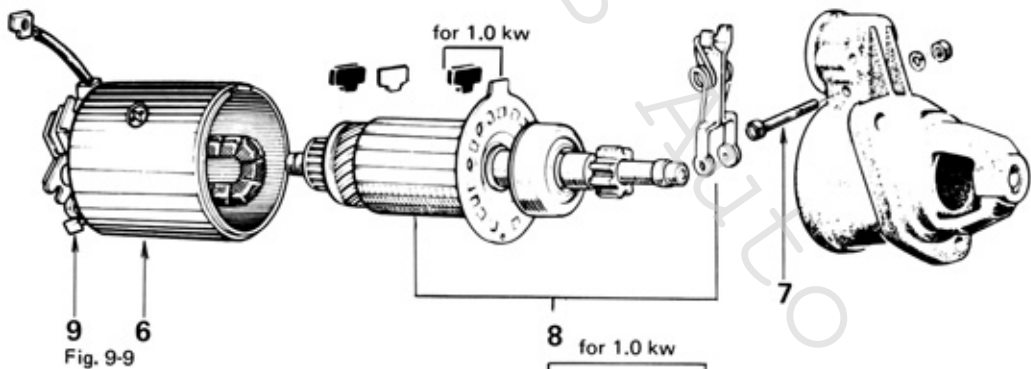
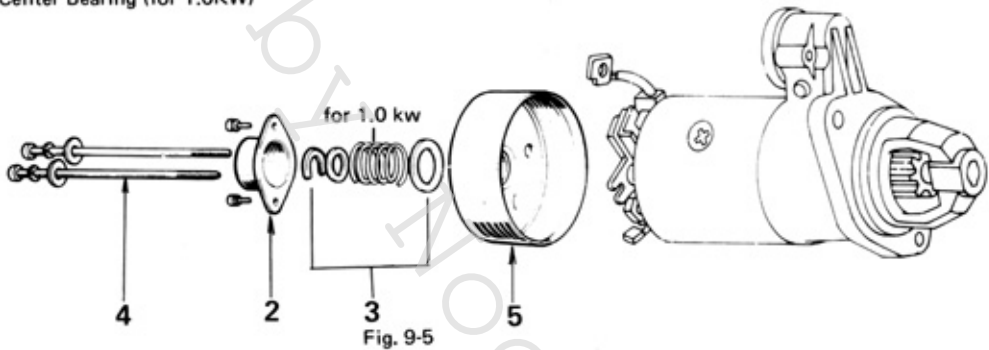
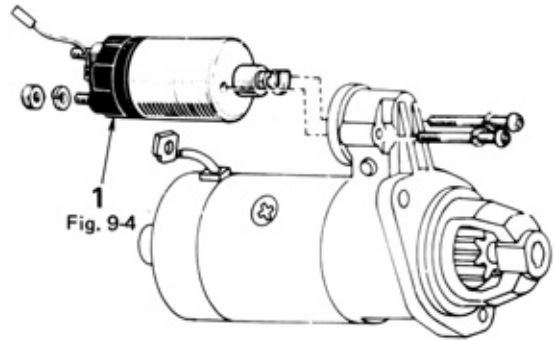
STARTER

DISASSEMBLY

Disassemble in numerical order.

Fig. 9-3

- 1 Magnetic Switch
- 2 Bearing Cover
- 3 Lock Plate and Spring
- 4 Bolt
- 5 Commutator End Frame
- 6 Yoke with Brush Holder
- 7 Drive Lever Bolt
- 8 Armature and Drive Lever
- 9 Brush Holder
- 10 Snap Ring
- 11 Stop Collar
- 12 Clutch with Pinion Gear
- 13 Center Bearing (for 1.0KW)



13

Fig. 9-8

Fig. 9-6

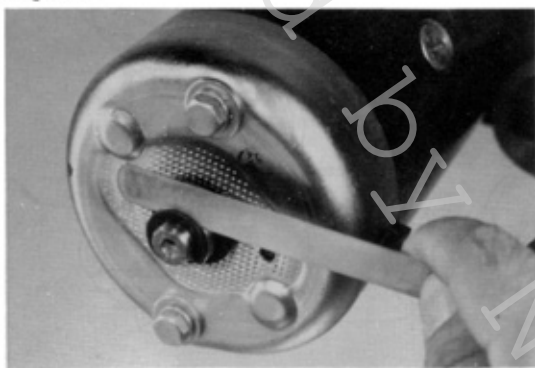
Fig. 9-7

Fig. 9-4



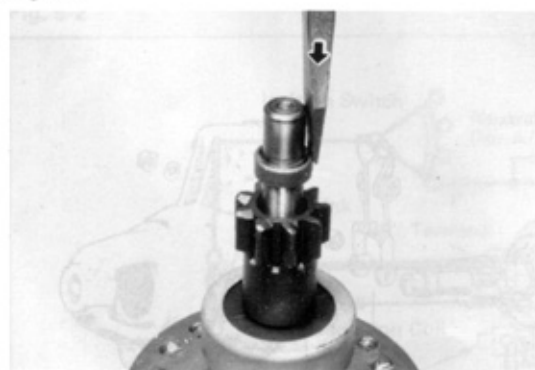
Disconnect lead wire before removing magnetic switch.

Fig. 9-5



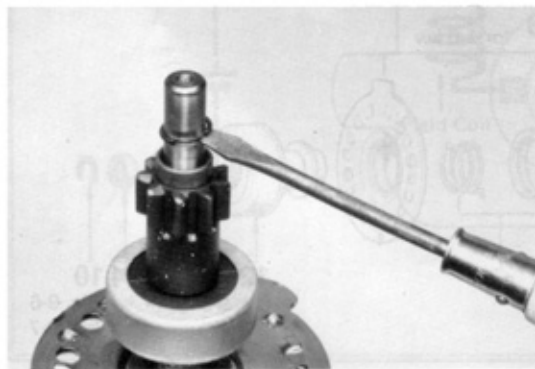
Check the armature shaft thrust clearance.
Thrust clearance limit 0.8 mm (0.032 in)

Fig. 9-6



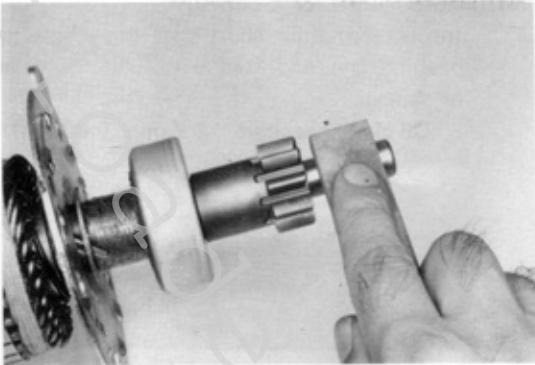
Tap in stop collar, using a screwdriver.

Fig. 9-7



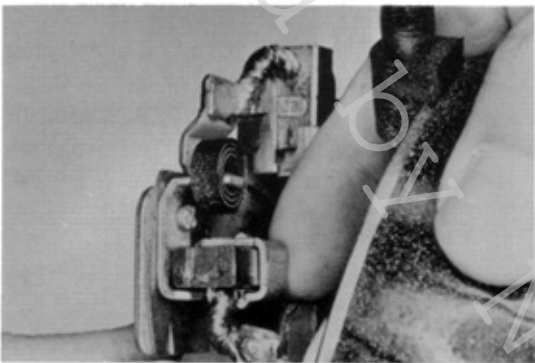
Pry the snap ring, using a screwdriver.

Fig. 9-8



If difficult to pull out the pinion, repair the shaft with an oil stone.

Fig. 9-9



Take off brushes and remove brush holder.

Fig. 9-11

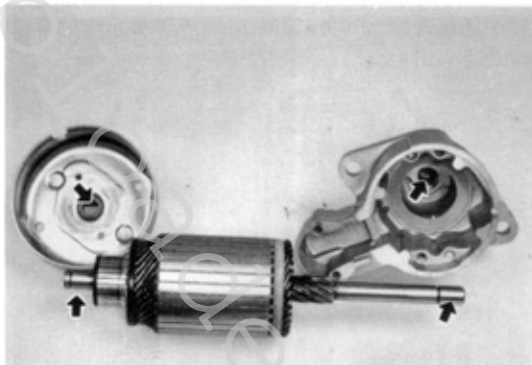


Fig. 9-12

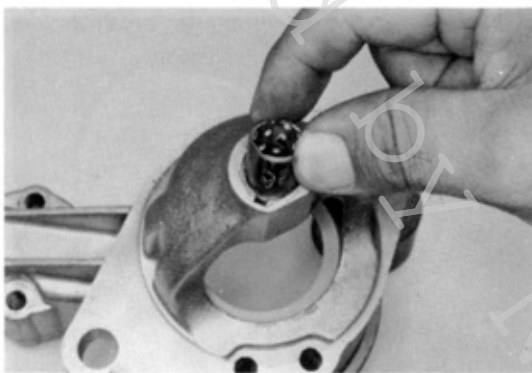


Fig. 9-13

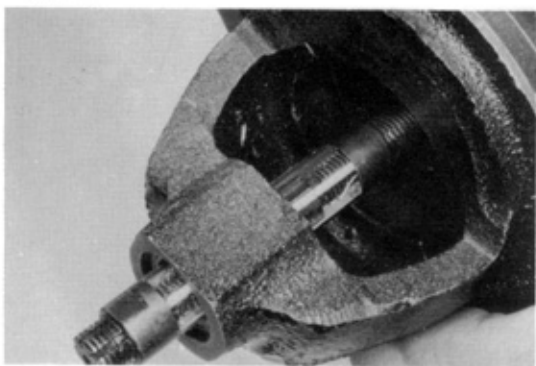
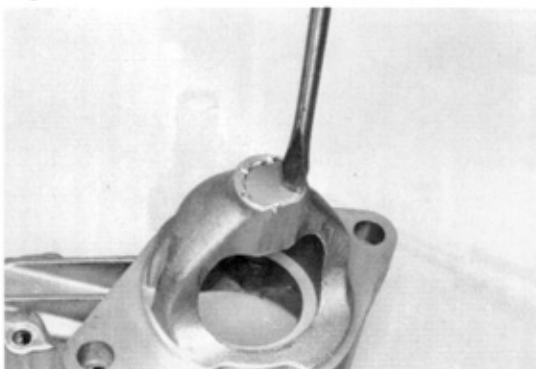


Fig. 9-14



INSPECTION AND REPAIR

Armature Shaft & Bearings



1. Inspect armature shaft end, drive housing bushing and end frame bushing for wear or damage.

Oil clearance limit 0.2 mm (0.008 in)



2. Bushing replacement.

- (1) Pry out the bushing cover and press out the bushing.
- (2) Aligning the bushing hole with the housing groove, Press in new bushing.

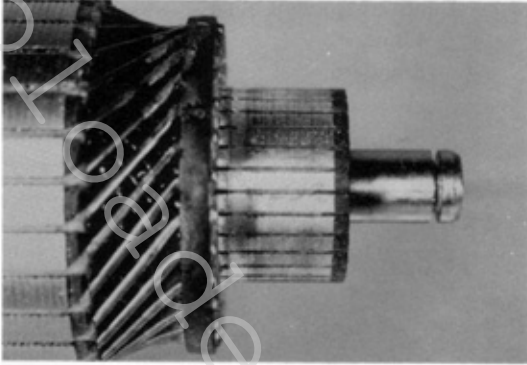
- (3) Ream bushing to obtain the specified clearance.

**Oil clearance 0.10 – 0.14 mm
(0.0039 – 0.0055 in)**



- (4) Clean the bore, and install new bushing cover.

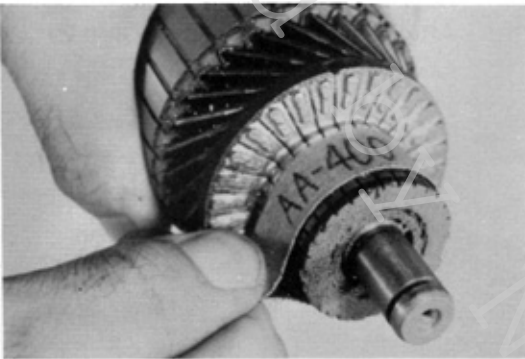
Fig. 9-15

**Commutator**

Inspect for the following items and repair or replace.

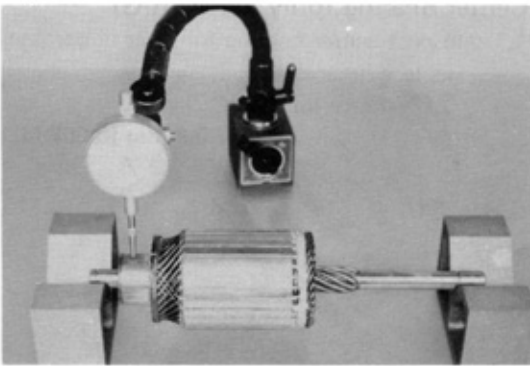
1. Dirty or burnt surface.
Correct by sandpaper or lathe if necessary.

Fig. 9-16



Use # 400 sandpaper.

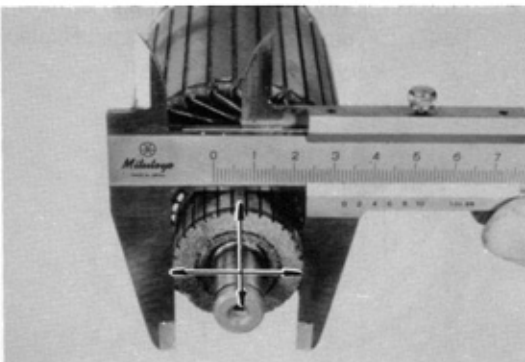
Fig. 9-17



2. Runout: Correct on a lathe if it exceeds the limit.

| | |
|---------------------|----------------------------|
| Runout limit | 0.4 mm (0.016 in) |
| Standard | 0.05 mm (0.0020 in) |

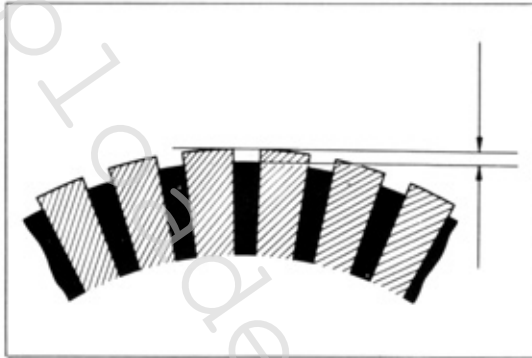
Fig. 9-18



3. Surface wear: If below the limit, replace armature.

| | |
|-----------------|---------------------------|
| Limit | 31 mm (1.22 in) |
| Standard | 32.7 mm (1.287 in) |

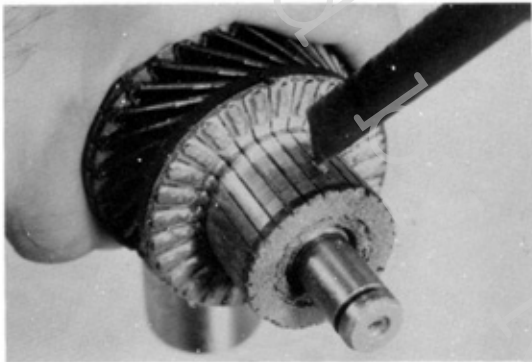
Fig. 9-19



4. Depth of segment mica.

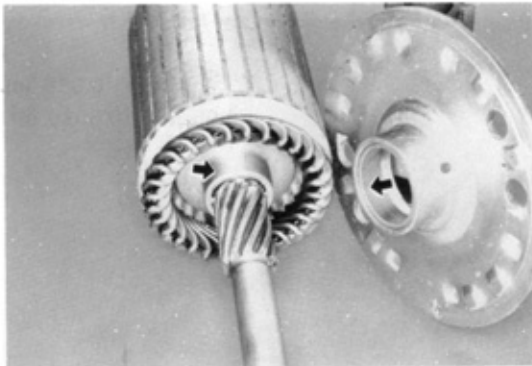
| | |
|-----------------|--------------------------------|
| Limit | 0.2 mm (0.008 in) |
| Standard | 0.5-0.8 mm (0.020-0.031 in) |

Fig. 9-20



Correct with a hacksaw blade.
After correcting, eliminate chips using sandpaper.

Fig. 9-21



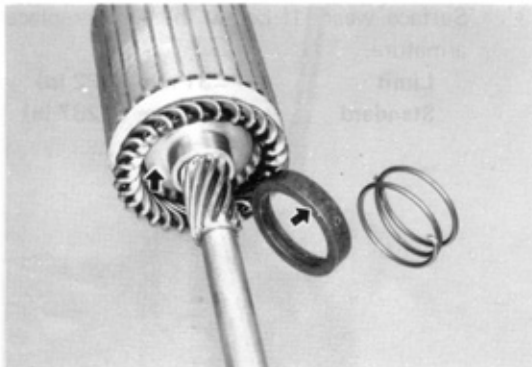
Center Bearing (only for 18R-G)

1. Inspect center bearing for wear or damage. Replace if necessary.

Clearance limit

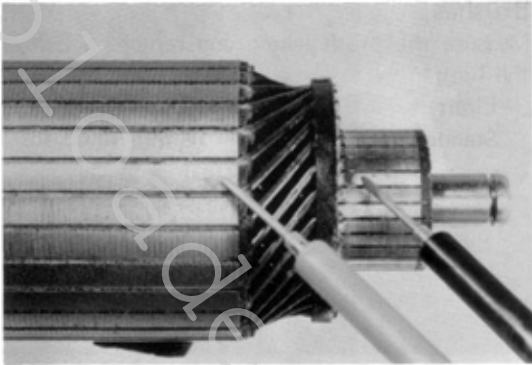
0.2 mm (0.008 in)

Fig. 9-22



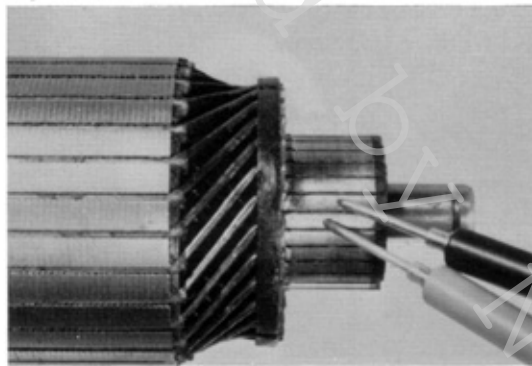
2. Inspect spring holder, spring and armature shaft for cracks, wear or damage. Replace if necessary.

Fig. 9-23

**Armature Coil**

1. Ground test
Check commutator and armature coil core. If there is continuity, the armature is grounded and must be replaced.

Fig. 9-24



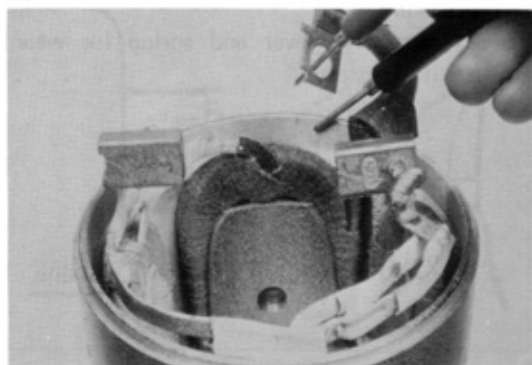
2. Open-circuit test
Check for continuity between the segments. If there is no continuity at any test point, there is an open-circuit and armature must be replaced.

Fig. 9-25

**Field Coil**

1. Open-circuit test
Check for continuity between the lead wire and field coil brush soldered connection. If there is no continuity, there is an open-circuit in the field coil, and it should be replaced.

Fig. 9-26



2. Ground test
Check for continuity between field coil end and field frame. If there is continuity, repair or replace the field coil.

Fig. 9-27

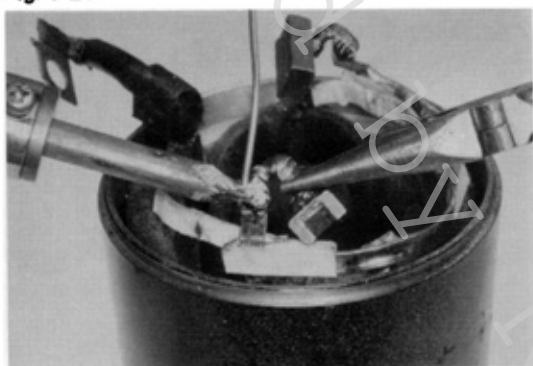
**Brushes**

Measure the brush length and replace if below the limit.

Limit
Standard

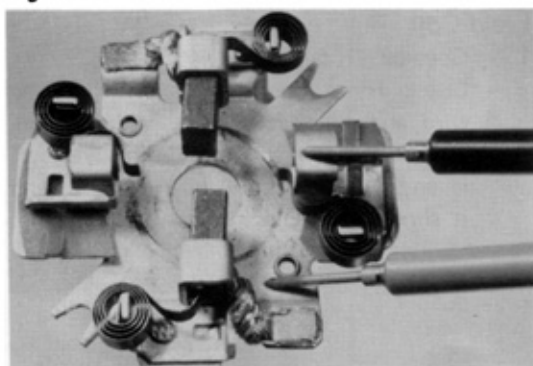
12 mm (0.47 in)
16 mm (0.63 in)

Fig. 9-28

**Brush Replacement**

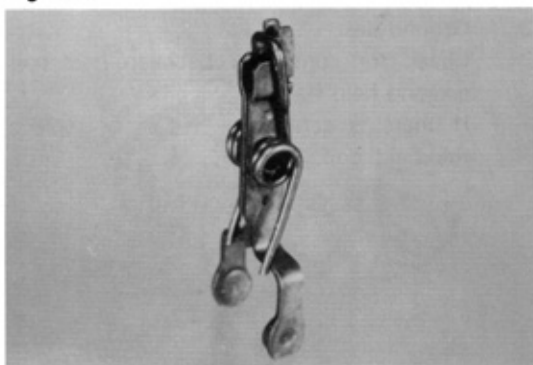
Solder brush lead firmly.

Fig. 9-29

**Brush Holder**

Check insulation between the (–) brush holder and (+) brush holder. Repair or replace if continuity is indicated.

Fig. 9-30

**Drive Lever**

Inspect the drive lever and spring for wear. Replace if necessary.

Fig. 9-31

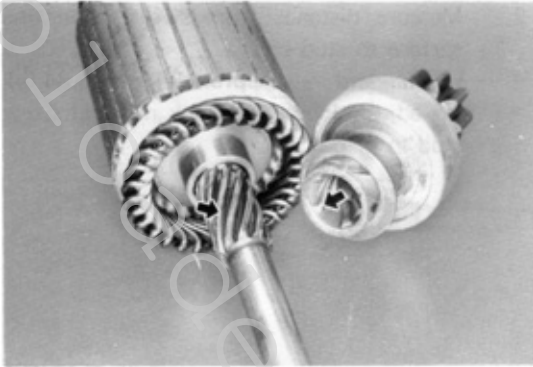


Fig. 9-32

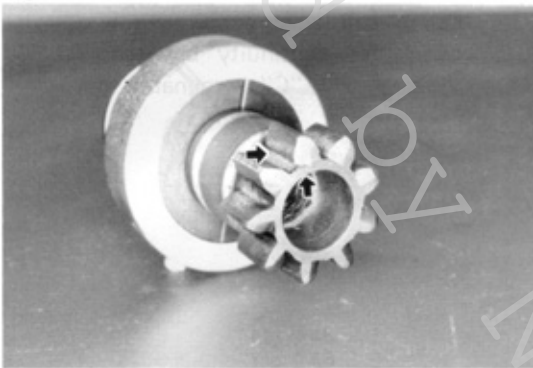
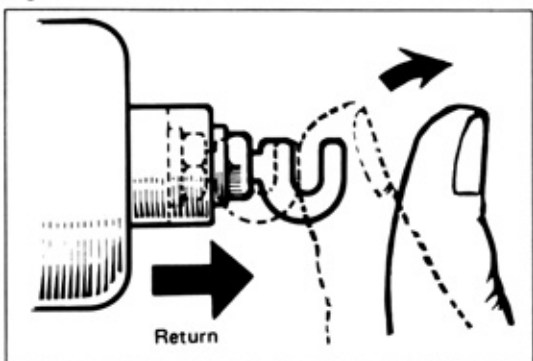


Fig. 9-33



Fig. 9-34

**Starter Clutch and Pinion Gear**

1. Inspect spline teeth for wear and damage. Replace if necessary.
2. Inspect pinion for smooth movement.



3. Inspect pinion gear teeth and chamfer if worn or damaged.



4. Rotate pinion. It should turn free in clockwise direction and lock when turned counterclockwise.

**Magnetic Switch**

1. Push in plunger and release it. The plunger should return quickly to its original position.

Fig. 9-35

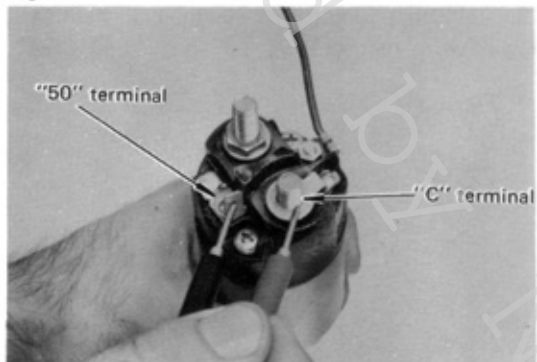


2. Measure distance from switch mounting surface to stud end.

Standard approx. 34 mm (1.34 in)

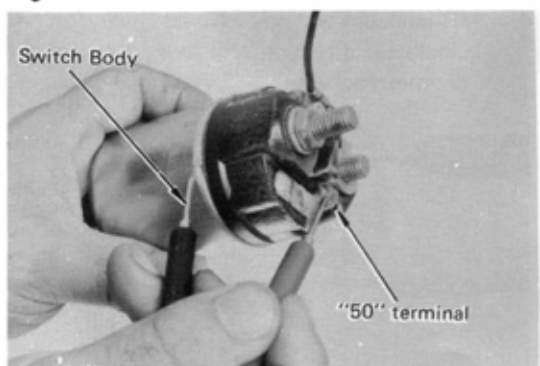
To adjust, loosen the lock nut and screw stud in or out.

Fig. 9-36



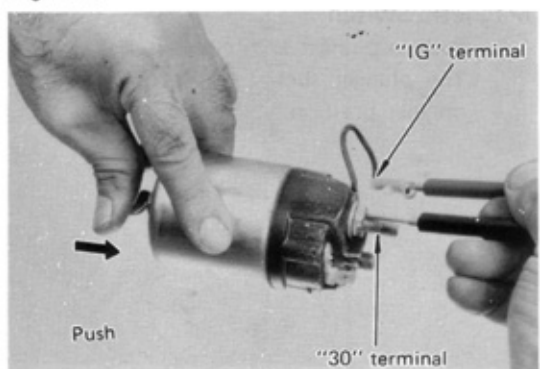
3. Pull-in coil open circuit test. Check for continuity between the "50" terminal and "C" terminal.

Fig. 9-37



4. Hold-in coil open circuit test. Check for continuity between the "50" terminal and switch body.

Fig. 9-38



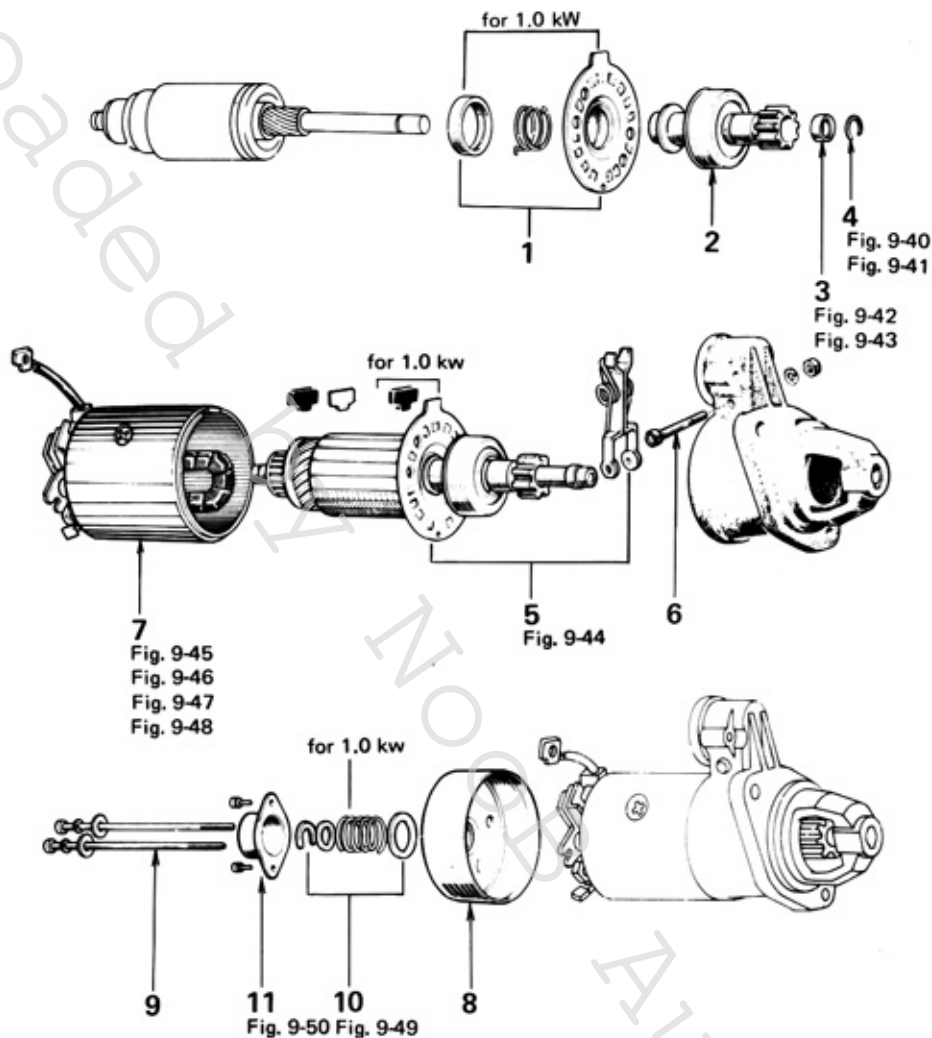
5. I.G. terminal continuity test. Push in plunger until it stops. Check for continuity between "30" terminal and lead wire.

— Note —

Perform the switch operation test after assembling it to the motor.

ASSEMBLY

Assemble in numerical order.

Fig. 9-39

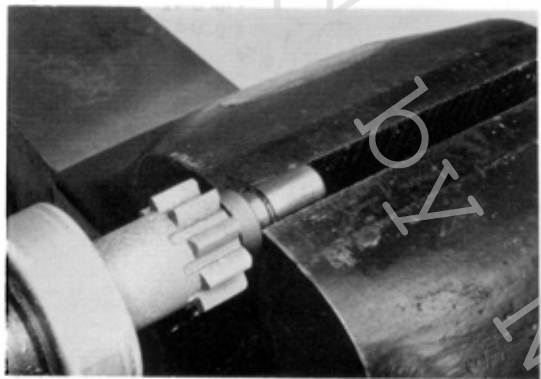
- 1 Center Bearing (for 1.0 kW)
- 2 Clutch with Pinion Gear
- 3 Stop Collar
- 4 Snap Ring
- 5 Armature and Drive Lever
- 6 Drive Lever Bolt
- 7 Yoke with Brush Holder
- 8 Commutator End Frame
- 9 Bolt
- 10 Lock Plate and Spring
- 11 Bearing Cover
- 12 Magnetic Switch

Fig. 9-40



Fit snap ring into shaft groove.

Fig. 9-41



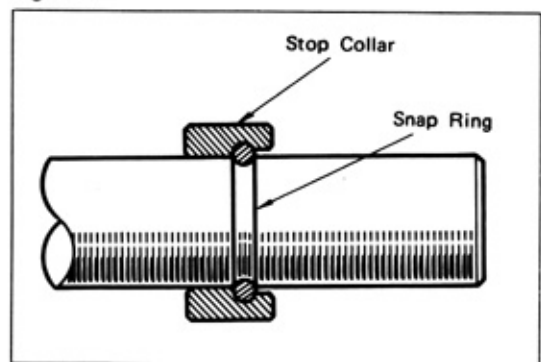
Compress the snap ring with a vise.

Fig. 9-42



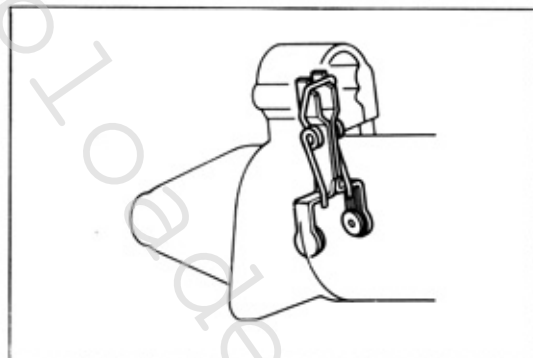
Tap pinion to slide the stop collar onto snap ring.

Fig. 9-43



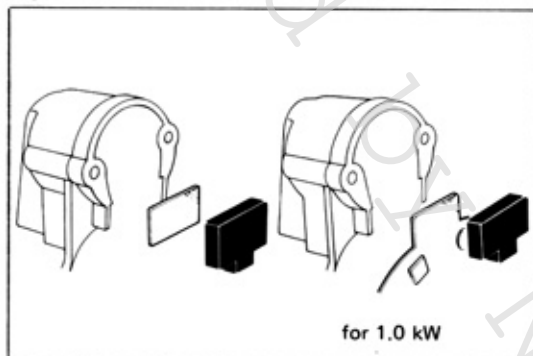
Make sure that the snap ring fits correctly.

Fig. 9-44



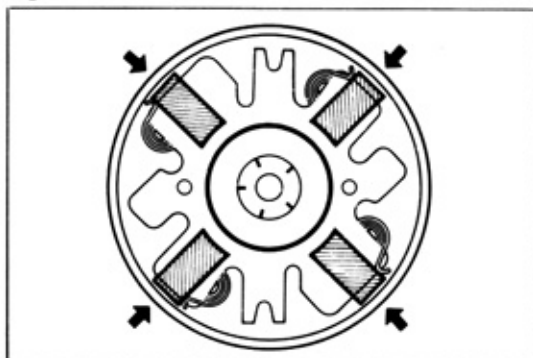
Assemble drive lever in direction as shown.

Fig. 9-45



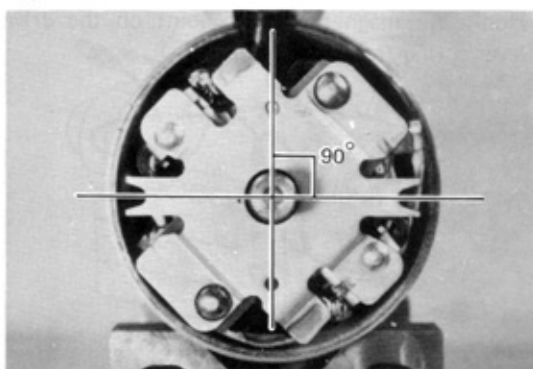
Match notch in yoke with tab on rubber plate and assemble yoke with drive housing.

Fig. 9-46



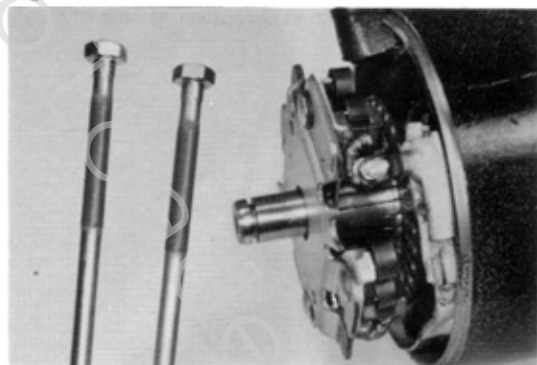
Assemble brushes, being careful not to damage them.

Fig. 9-47



After installation, position the holder as shown.

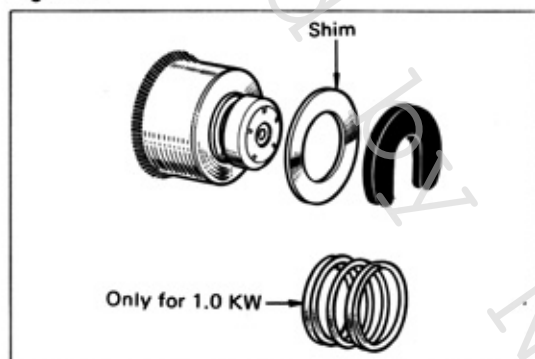
Fig. 9-48



Check that the (+) wires are not grounded.

- Field coil
- Brush (+) leads
- Through bolts

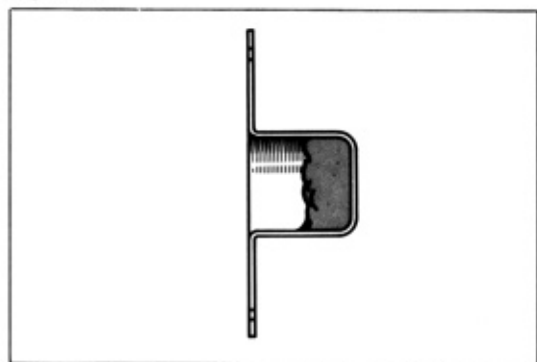
Fig. 9-49



Install the lock plate and measure the armature shaft thrust clearance. If clearance exceeds the specified value, correct by increasing the number of shims.

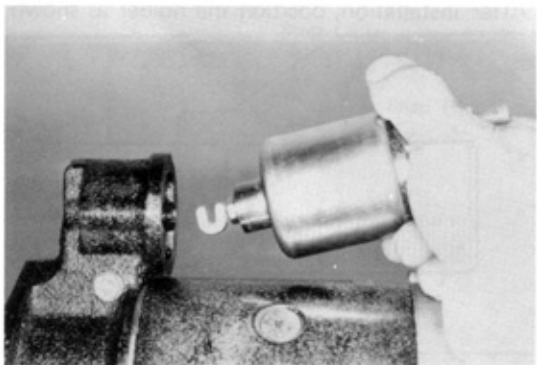
| | |
|---------------------------------|---|
| Thrust clearance | 0.05-0.35 mm (0.002-0.0138 in) |
| Adjusting shim thickness | 0.5 mm (0.02 in) |

Fig. 9-50



Install end frame cap not more than half full of grease.

Fig. 9-51



Hook the magnetic switch joint on the drive lever spring from the lower side.

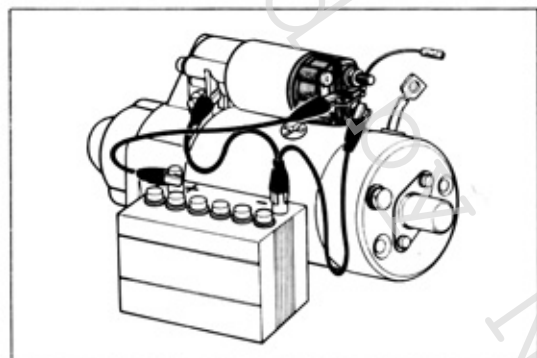
– Precaution –

These tests must be performed in short time (3-5 seconds) to prevent the coil from burning. Disconnect the field coil lead from "C" terminal.

PERFORMANCE TEST

Check the magnetic switch performance and pinion gap as follows:

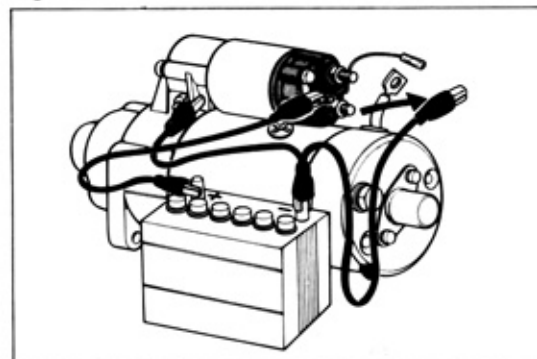
Fig. 9-52



1. Pull-in test

Connect magnetic switch to battery as shown. (negative side to "C" terminal and switch body; positive side to "50" terminal). If the pinion has definitely jumped out, the pull-in coil is satisfactory.

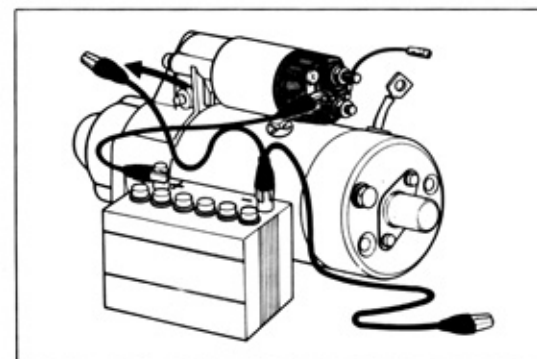
Fig. 9-53



2. Hold-in test

Next disconnect the "C" terminal. The pinion should remain in jumped-out condition.

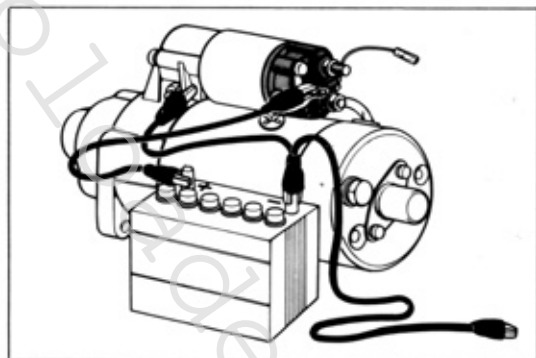
Fig. 9-54



3.

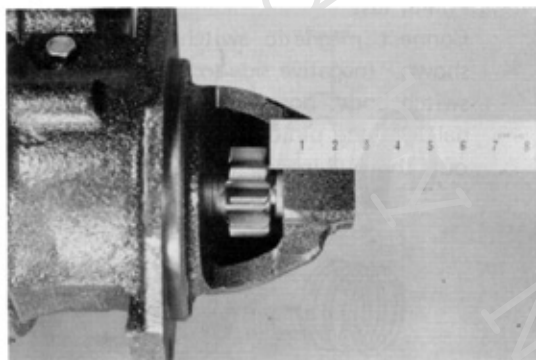
Check the plunger return. When disconnecting the switch body, the pinion should return quickly.

Fig. 9-55



4. Check the pinion clearance.
- (1) Connect the magnetic switch to battery as shown.
Field coil lead to "C" terminal
Battery negative side to body
Battery positive side to 50 terminal

Fig. 9-56



- (2) Move the pinion to armature side to eliminate the slack, and check the clearance between the pinion end and stop collar.

Standard clearance

**1.0-4.0 mm
(0.04-0.16 in)**

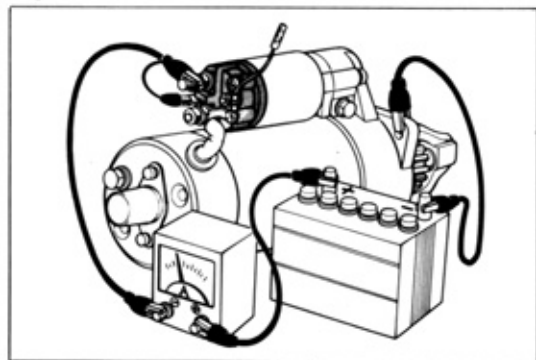
Fig. 9-57



- (3) Adjust if necessary after loosening lock nut.

| <u>Clearance</u> | <u>Stud</u> |
|------------------|-------------|
| Too large | → Screw in |
| Too small | → Screw out |

Fig. 9-58



5. No-load performance test
- Connect the field coil lead to the "C" terminal, making sure that the lead wire is not grounded.
- Connect starter to battery. If the starter shows smooth and steady rotation with the pinion jumping out and draws less than specified current, it is satisfactory.

Specified current

Less than 50 A

IGNITION SYSTEM

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| INSPECTION & REPAIR..... | 10- 5 |
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| DISTRIBUTOR (18R-G) | |
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| IGNITION COIL | 10- 25 |
| HIGH TENSION CORD | 10- 26 |
| SPARK PLUG | 10- 27 |

IGNITION SYSTEM CIRCUIT

Fig. 10-1

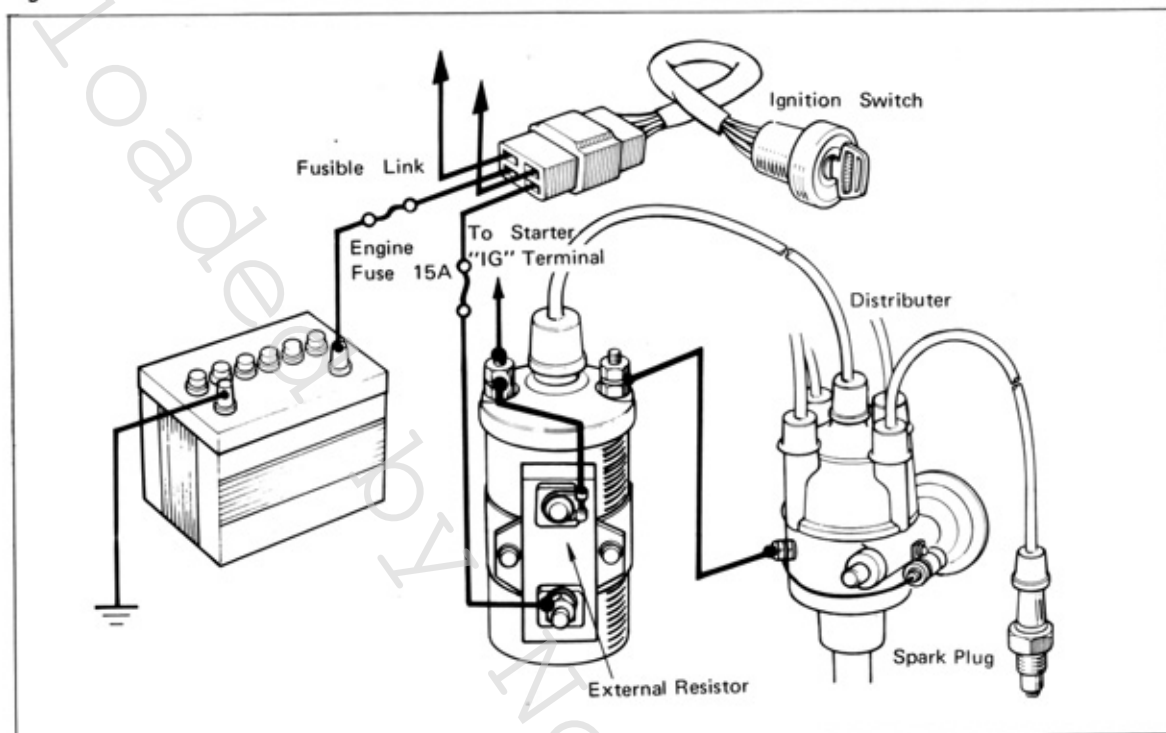
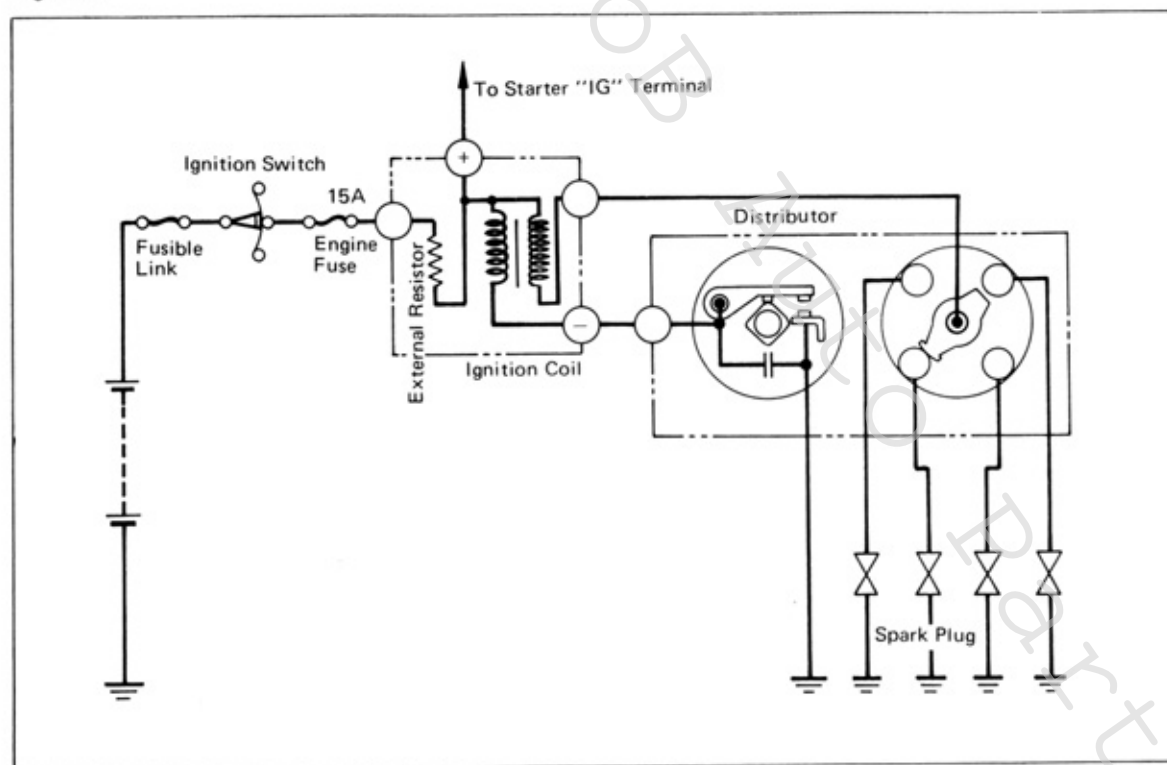


Fig. 10-2



DISTRIBUTOR (18R)**DISASSEMBLY**

Disassemble in numerical order.

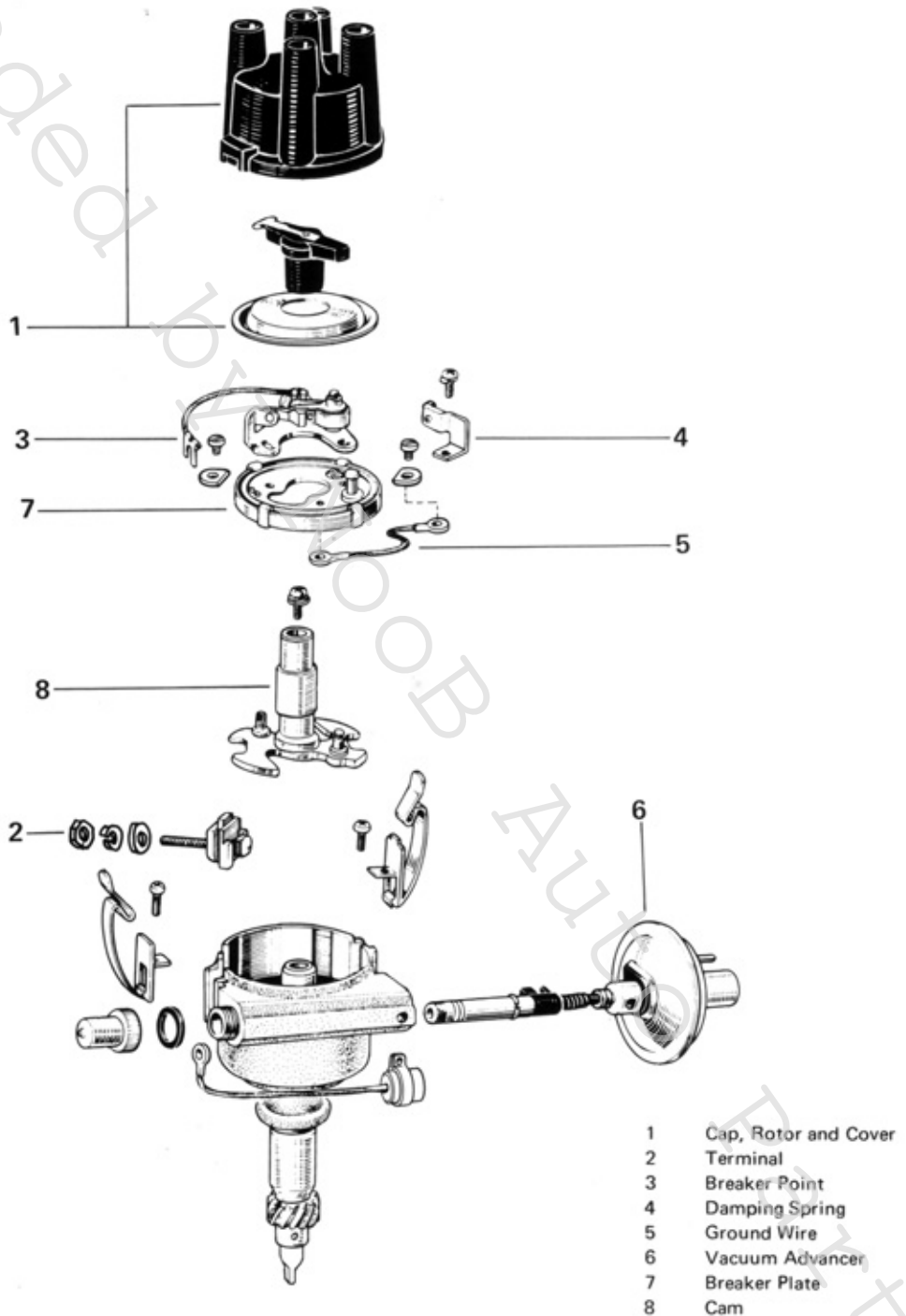
Fig. 10-3

Fig. 10-4

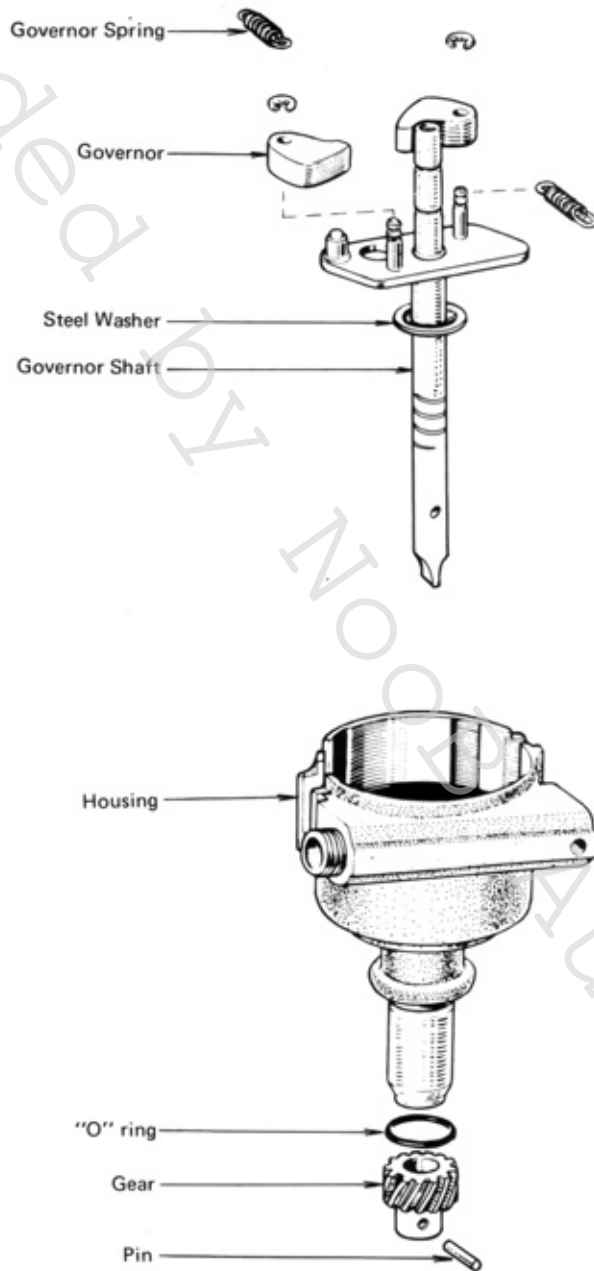


Fig. 10-5

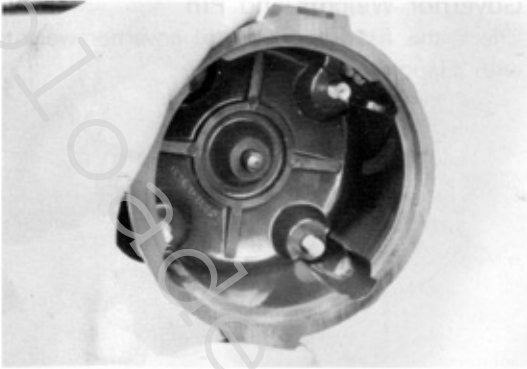


Fig. 10-6



Fig. 10-7

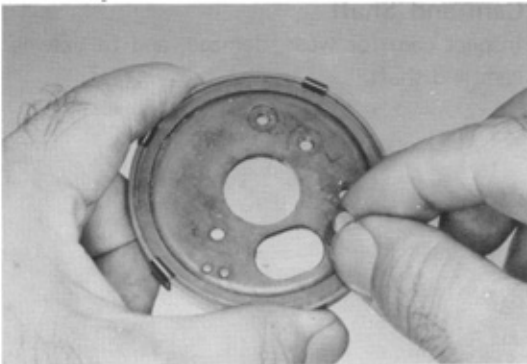
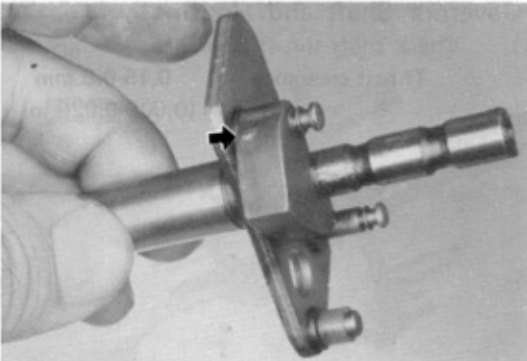


Fig. 10-8



INSPECTION & REPAIR



Cap

Inspect for cracks, carbon tracks, burnt or corroded terminals, and check center contact for wear.



Rotor

Inspect for cracks, carbon tracks, burnt or corroded terminals.



Breaker Plate

Check breaker plate for smooth rotation.



Governor Weights

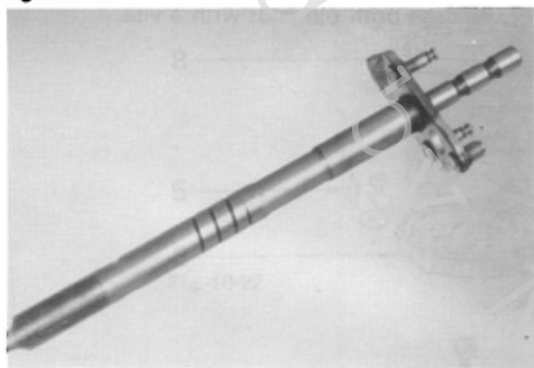
Inspect governor weights for damage.

Fig. 10-13



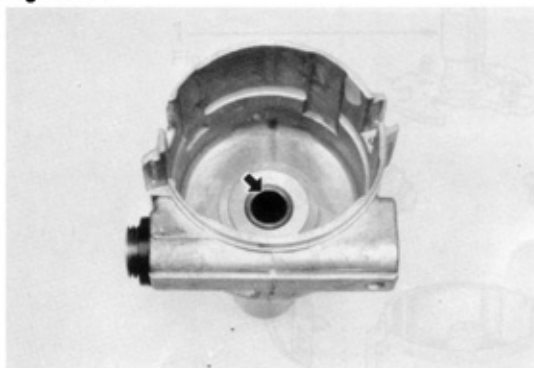
2. Remove gear and pin .
Grind off the pin end, then remove the pin and gear.

Fig. 10-14



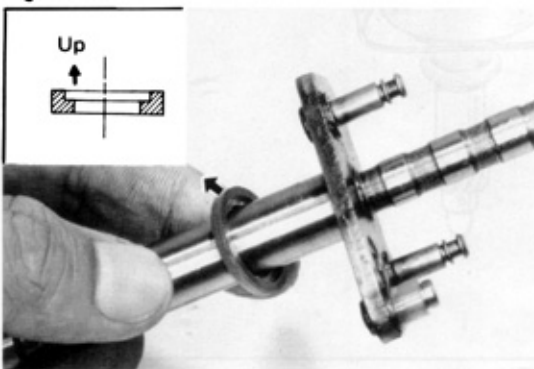
3. Inspect governor shaft for wear and damage.

Fig. 10-15



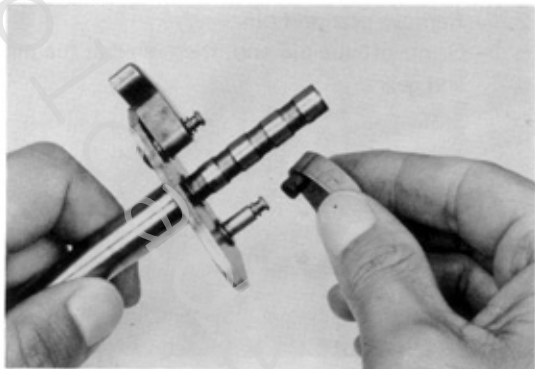
4. Inspect housing bushings, and O ring for wear, deformation, and damage.

Fig. 10-16



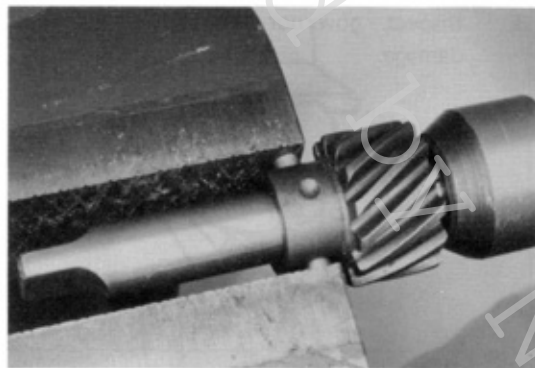
5. Assemble washer as shown.

Fig. 10-17



6. Assemble bearing between pin and weight.

Fig. 10-18



7. Peen both pin ends with a vise.

ASSEMBLY

Assemble in numerical order.

Fig. 10-19

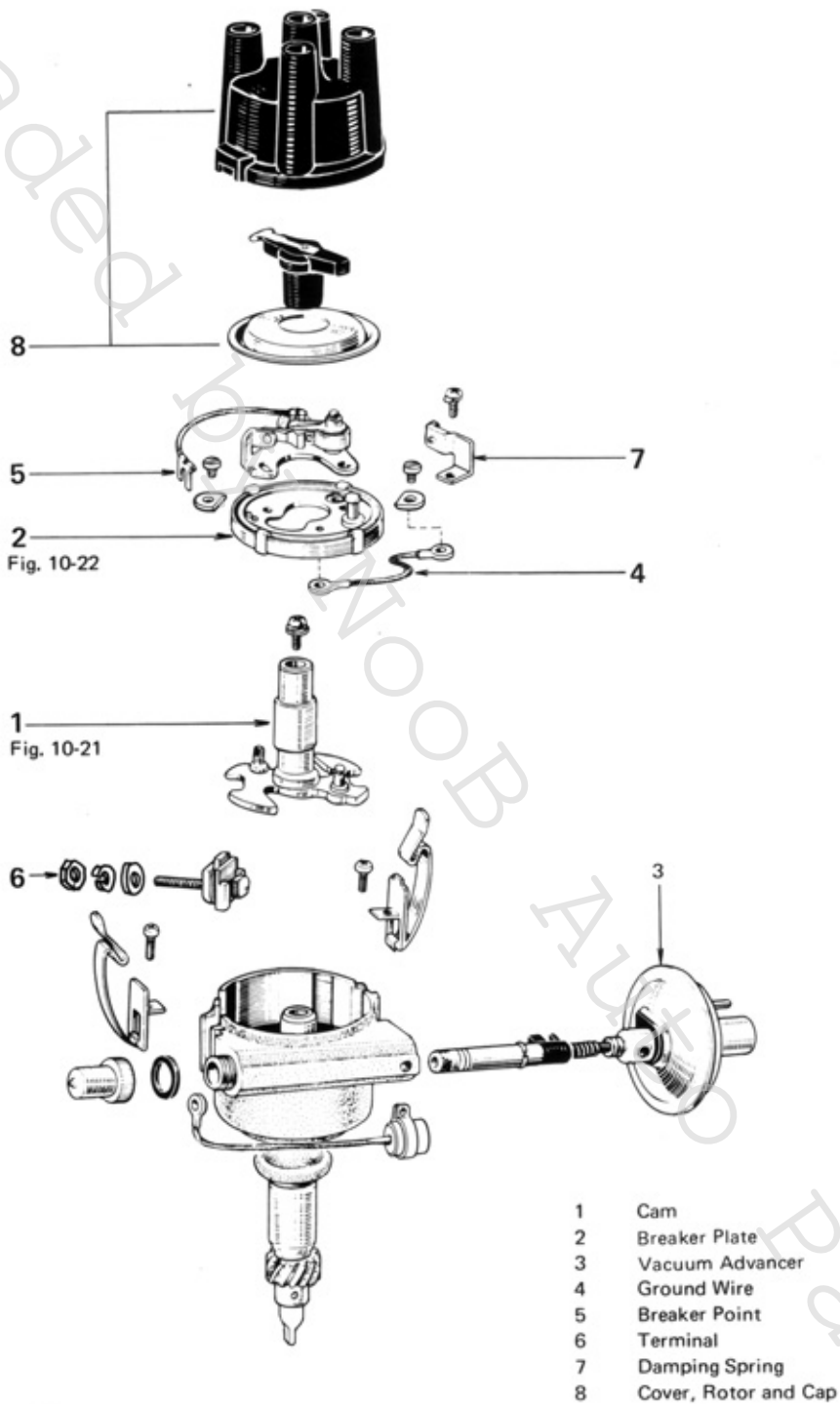


Fig. 10-20

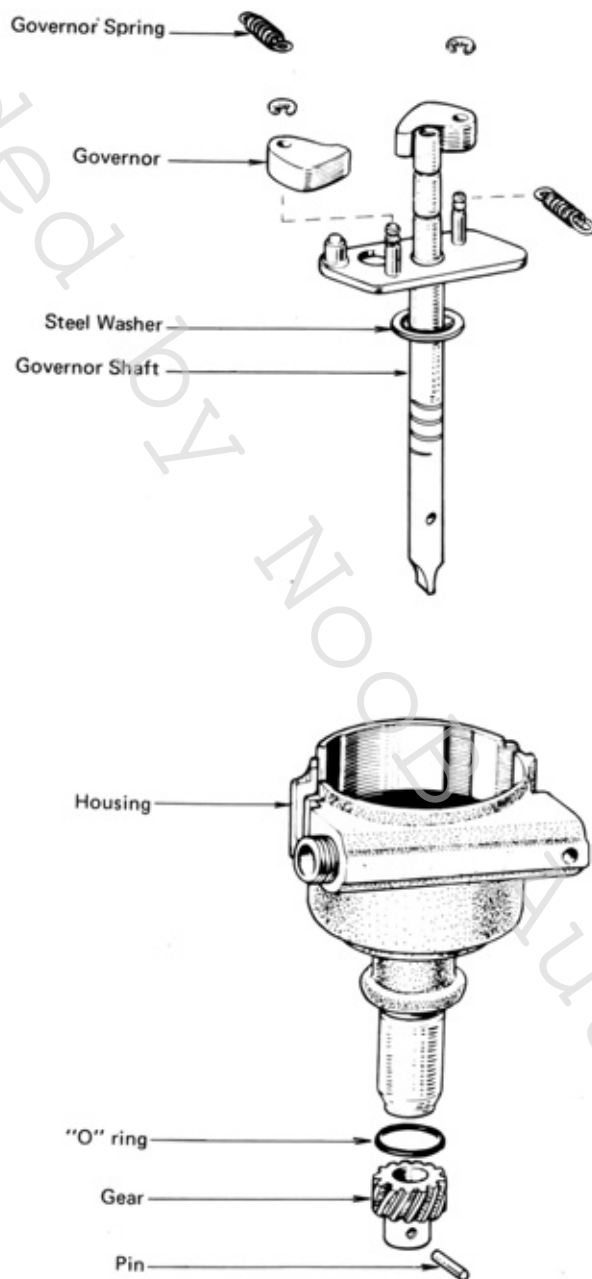
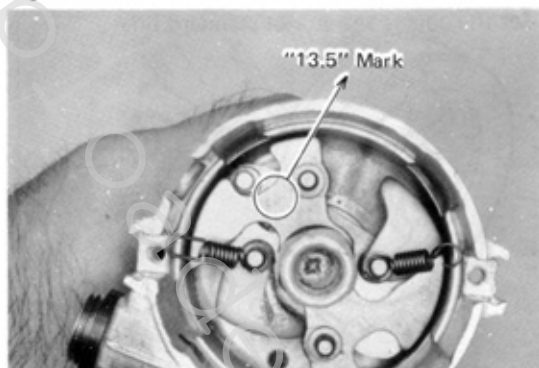
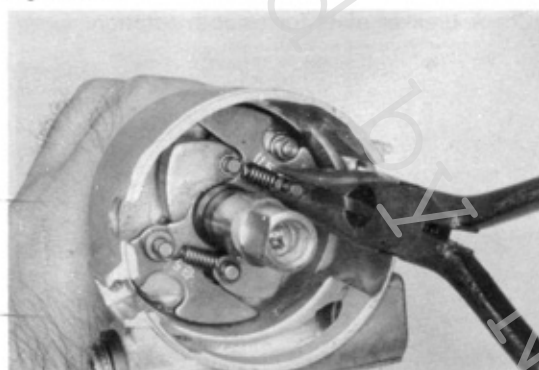


Fig. 10-21



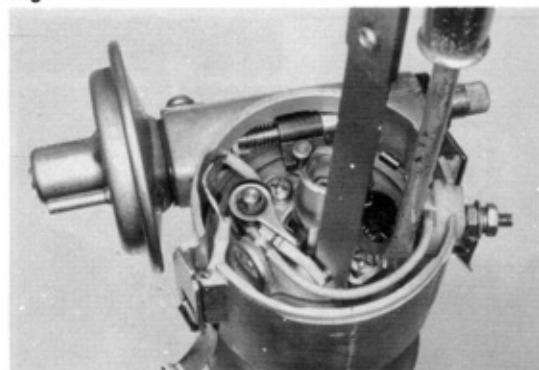
Match 13.5 mark with stopper, fit on the cam and tighten with screw.

Fig. 10-22



Assemble governor weights and lock with E ring. Install governor springs.

Fig. 10-23

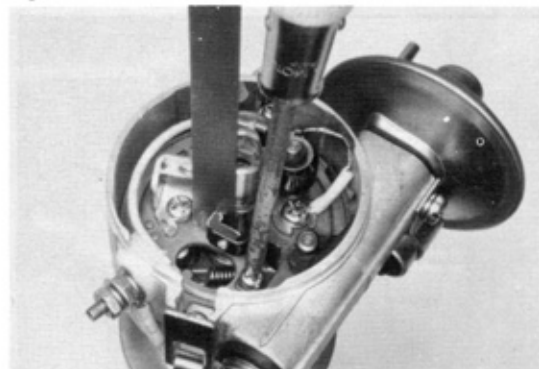


ADJUSTMENT

Install breaker points and adjust the gap.

Point gap 0.45 mm (0.018 in)

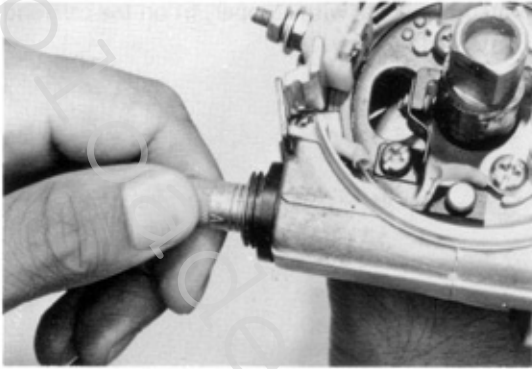
Fig. 10-24



Install damping spring and adjust it.

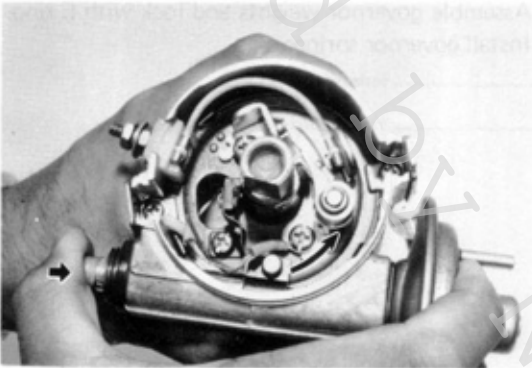
Damping spring gap 0.1-0.4 mm
(0.004-0.016 in)

Fig. 10-25



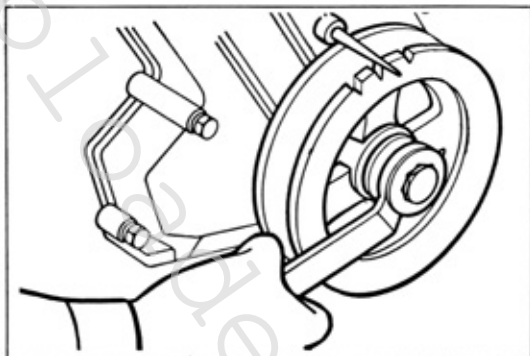
Set the octane selector at standard line.

Fig. 10-26



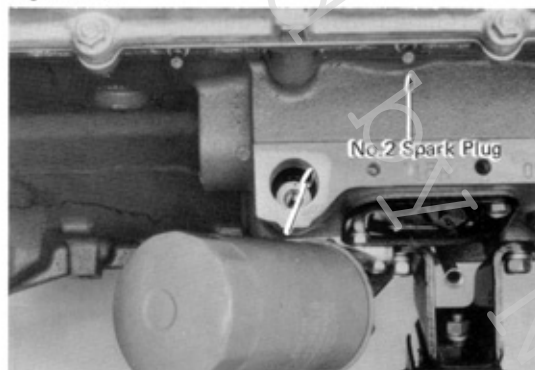
Check breaker plate for smooth rotation.

Fig. 10-27

**INSTALLATION**

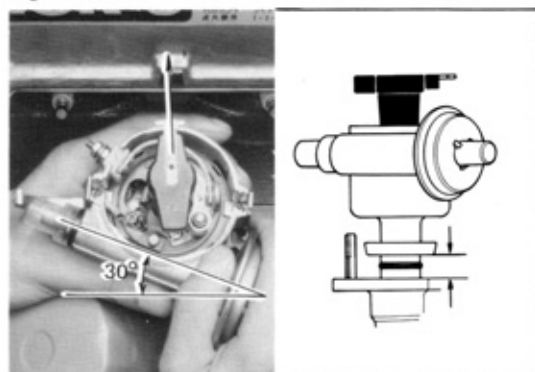
1. Set No. 1 cylinder to 7° BTDC/compression. Align the timing mark with pointer. At this time, rocker arms on No.1 cylinder should be loose and rockers on No.4 should be tight.

Fig. 10-28



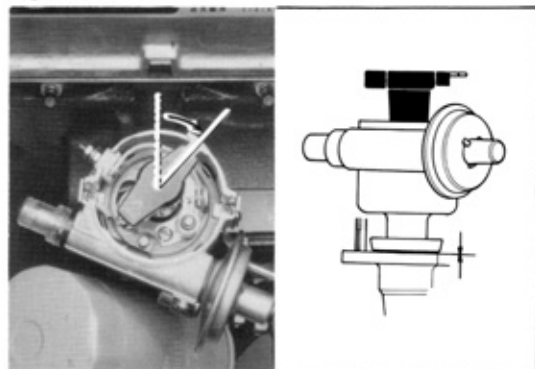
2. Set the oil pump shaft slot in direction as shown.

Fig. 10-29



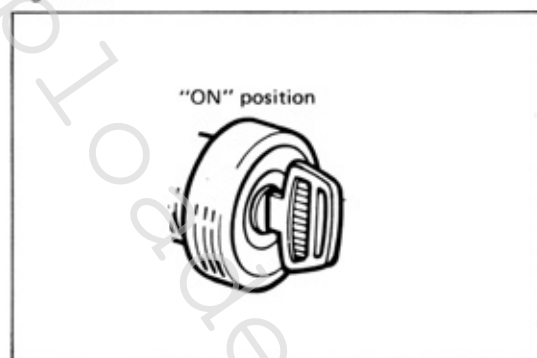
3. Before inserting the distributor, position the rotor and diaphragm as shown.

Fig. 10-30



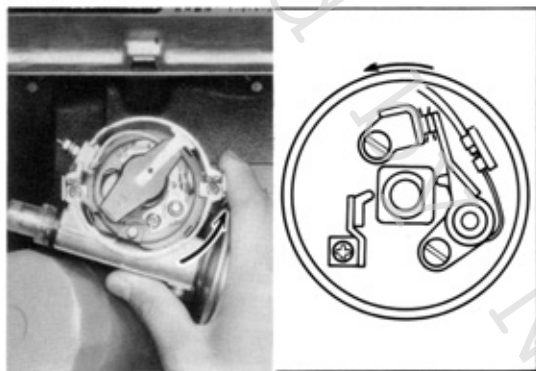
4. When fully installed, rotor should point toward as shown.

Fig. 10-31



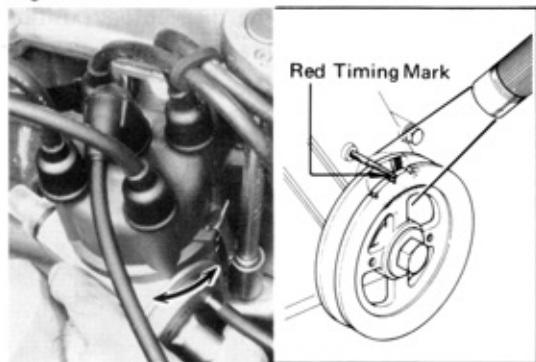
5. Turn ignition switch to ON position. Do not turn the starter motor.

Fig. 10-32



6. Rotate the distributor body counter-clockwise until when just sparking between points, then, tighten the clamp bolt in that position.

Fig. 10-33



7. Check ignition timing in idling condition.
Ignition timing 7° BTDC

If necessary, align the timing marks by turning distributor body.

DISTRIBUTOR (18R-G)

DISASSEMBLY

Disassemble in numerical order.

Fig. 10-34

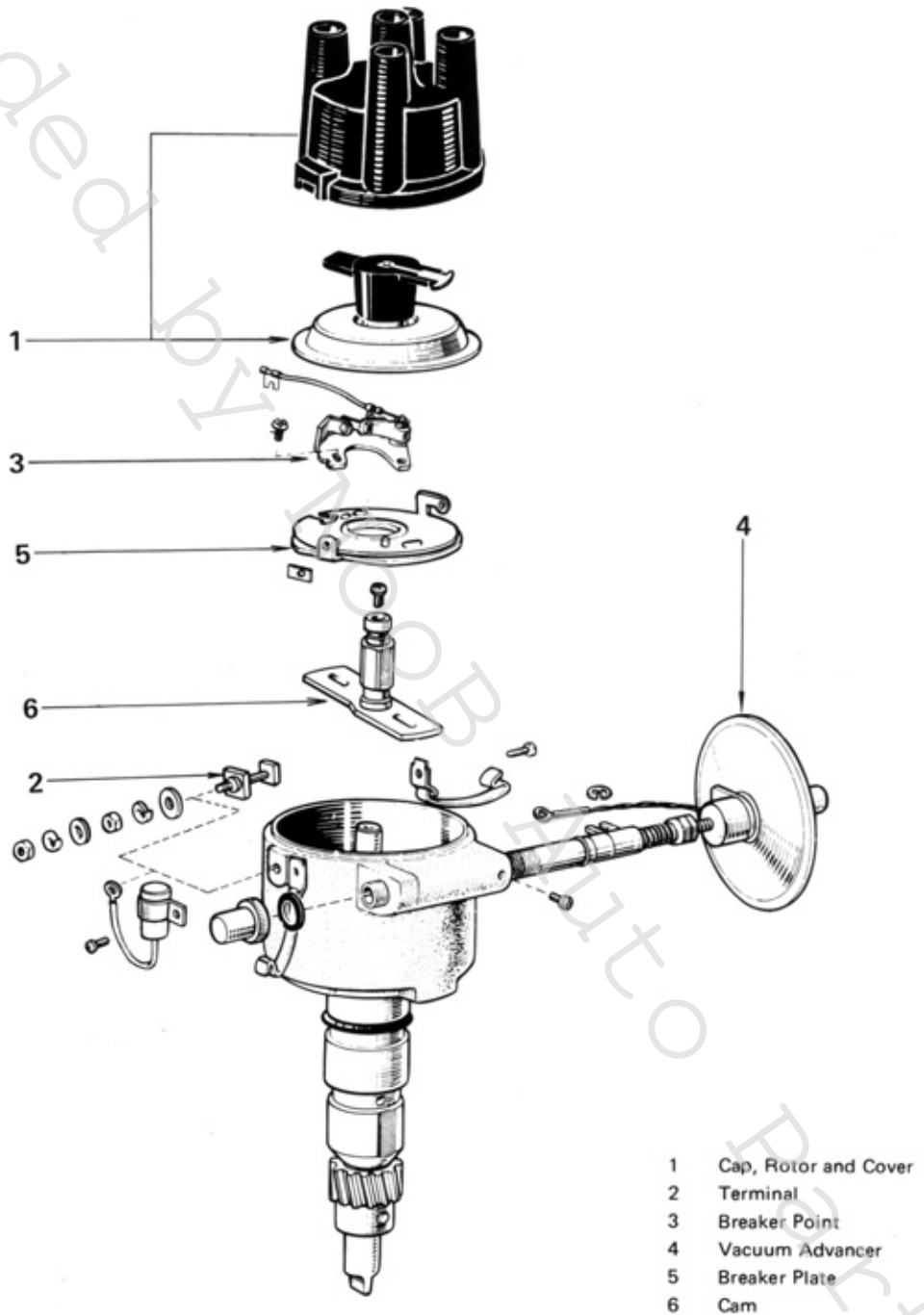


Fig. 10-35

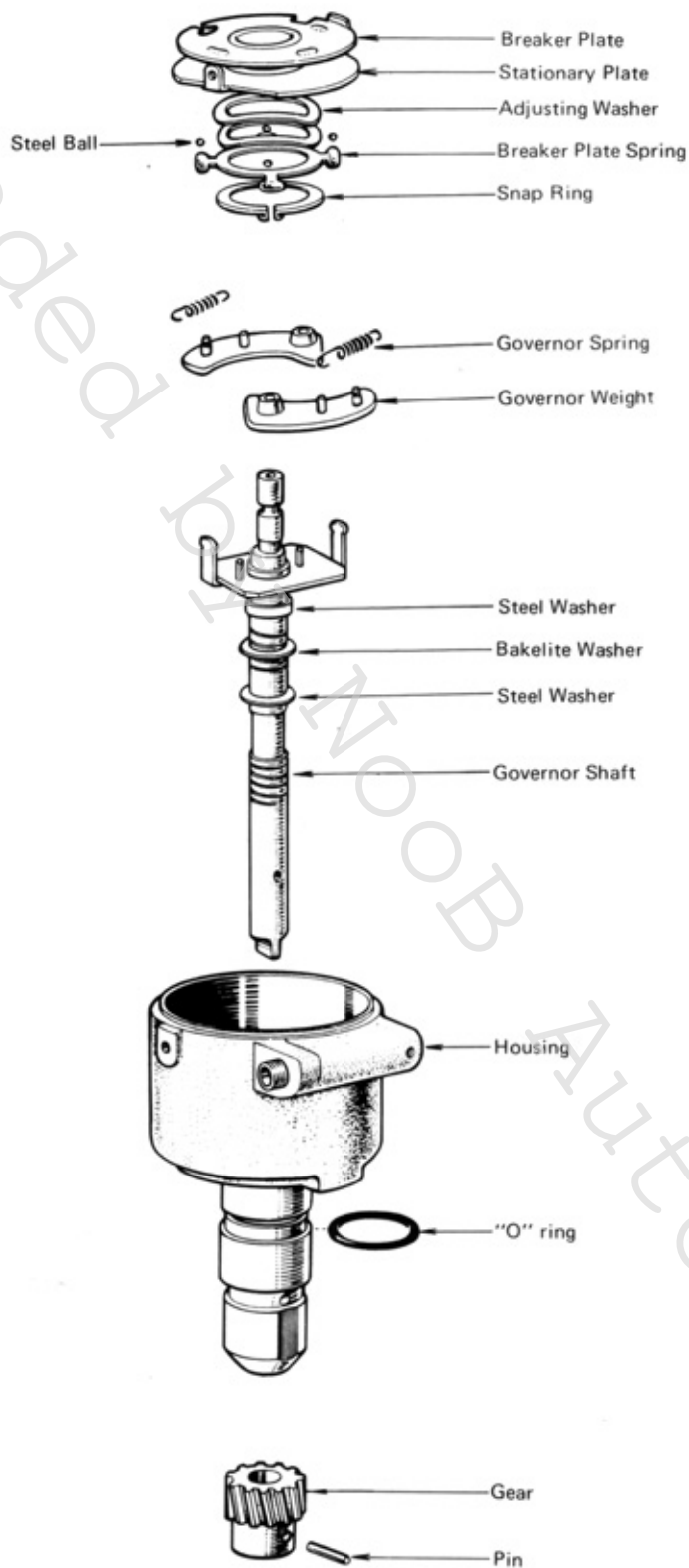
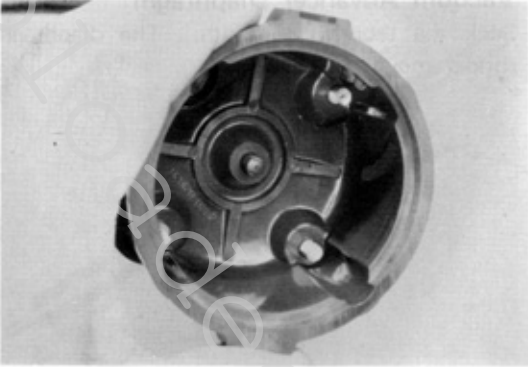


Fig. 10-36



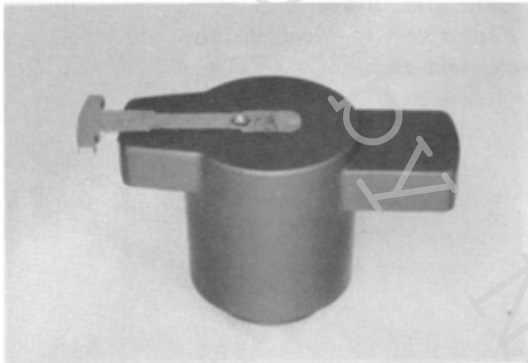
INSPECTION & REPAIR



Cap

Inspect for cracks, carbon tracks, burnt or corroded terminals, and check center contact for wear.

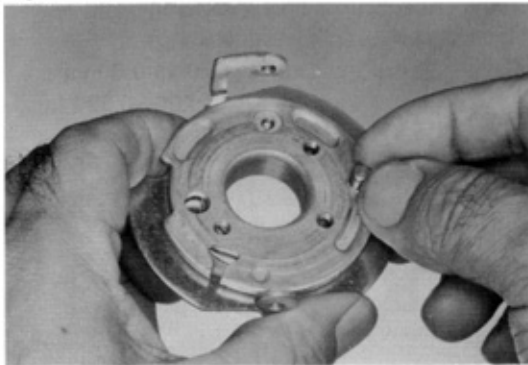
Fig. 10-37



Rotor

Inspect for cracks, carbon tracks, burnt or corroded terminals.

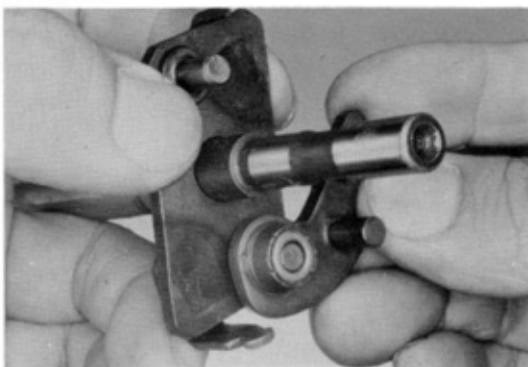
Fig. 10-38



Breaker Plate

Check breaker plate for smooth rotation.

Fig. 10-39



Governor Weights and Pin

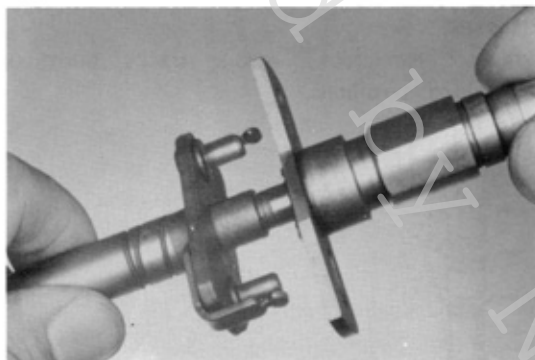
Check the fitting portions of governor weights with support pins for binding.

Fig. 10-40

**Vacuum Advancer Diaphragm**

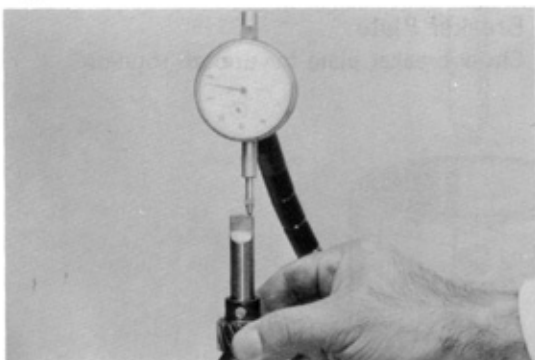
Suck the tube with mouth. The diaphragm should move.

Fig. 10-41

**Cam and Shaft**

Inspect cam for wear, damage, and fit between cam and shaft.

Fig. 10-42

**Governor Shaft and Housing**

1. Check shaft thrust clearance.

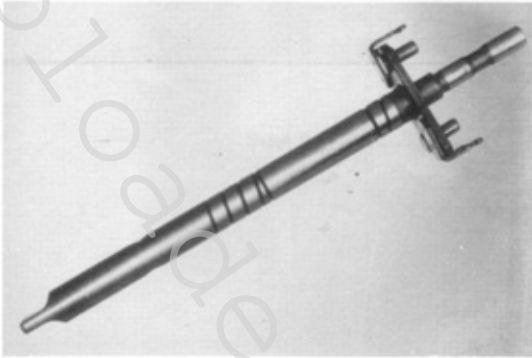
Thrust clearance **0.15-0.5 mm**
 (0.006-0.020 in)

Fig. 10-43



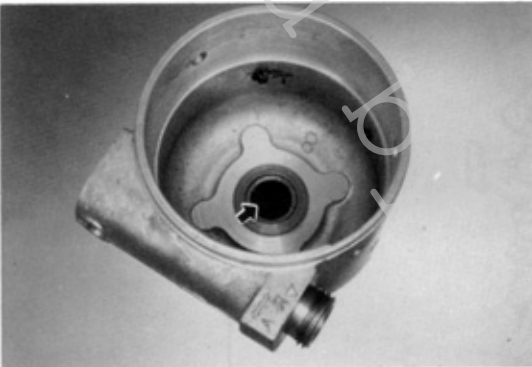
2. Remove gear and pin.
 Grind off the pin end, then remove the pin and gear.

Fig. 10-44



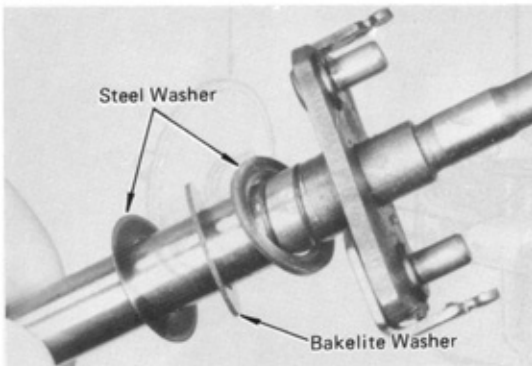
3. Inspect governor shaft for wear and damage.

Fig. 10-45



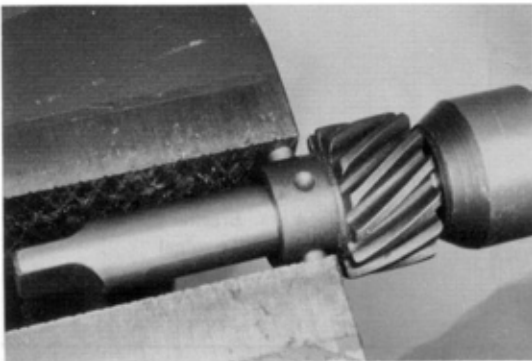
4. Inspect housing bushings, and O ring for wear, deformation, and damage.

Fig. 10-46



5. Assemble washers as shown.

Fig. 10-47



6. Peen both pin ends with a vise.

ASSEMBLY

Assemble in numerical order.

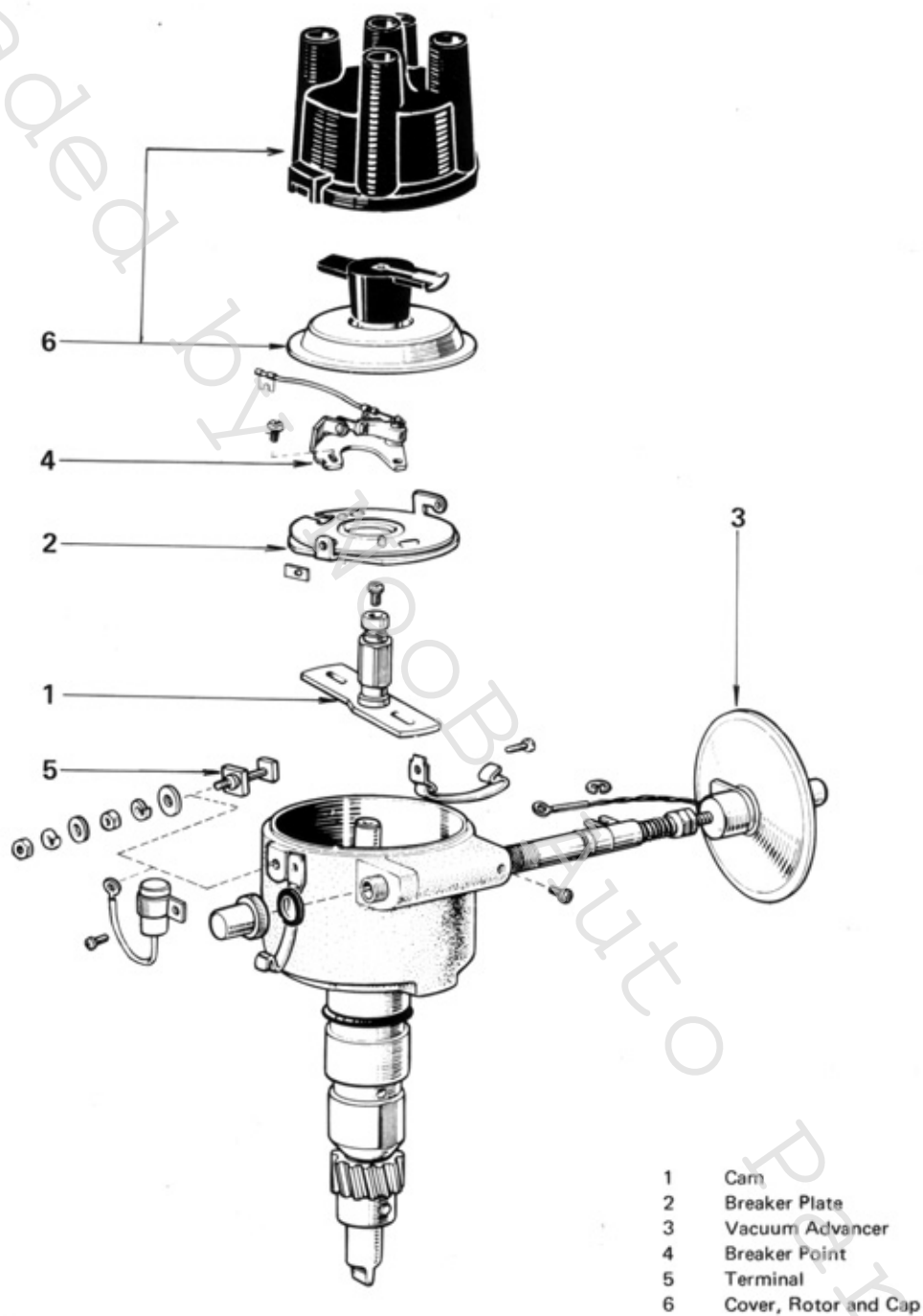
Fig. 10-48

Fig. 10-49

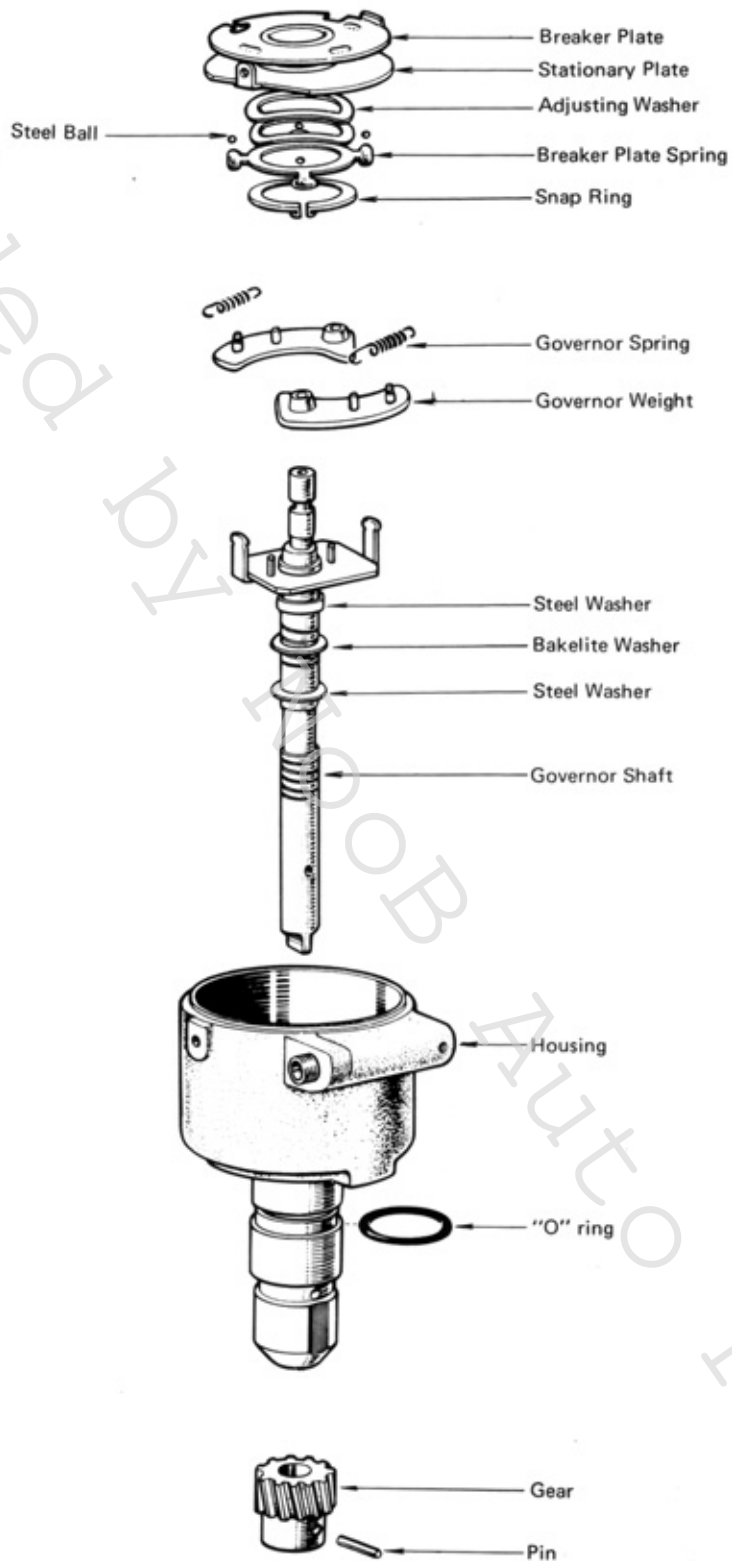
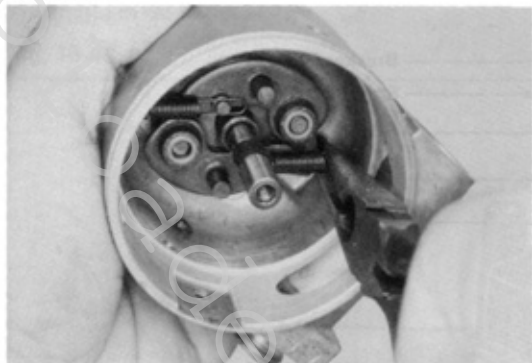
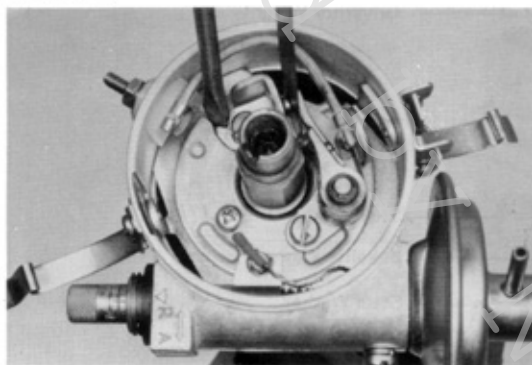


Fig. 10-50



Install governor springs in direction as shown.

Fig. 10-51

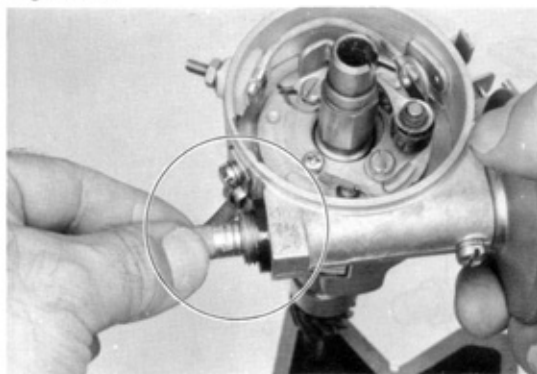


ADJUSTMENT

Install breaker points and adjust the gap.

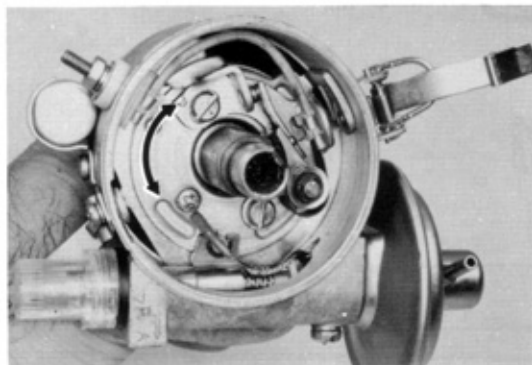
Point gap 0.45 mm (0.018 in)

Fig. 10-52



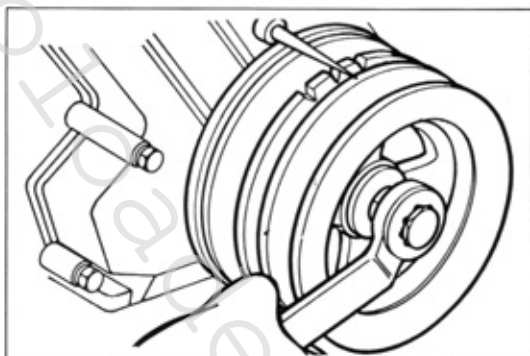
Set the octane selector at standard line.

Fig. 10-53



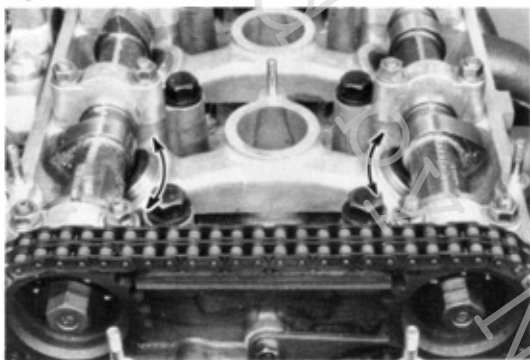
Check breaker plate for smooth rotation.

Fig. 10-54

**INSTALLATION**

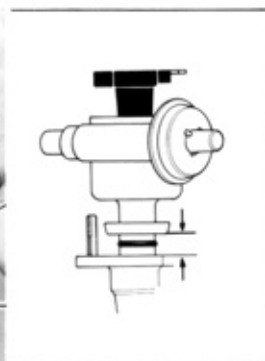
1. Set No. 1 cylinder to 5° BTDC/compression. Align the timing mark with pointer.

Fig. 10-55



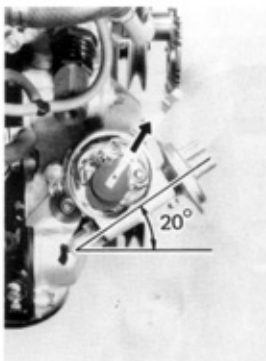
2. At this time, intake and exhaust valve lifter on No.1 cylinder should be rotate and valve lifters on No.4 should be tight.

Fig. 10-56



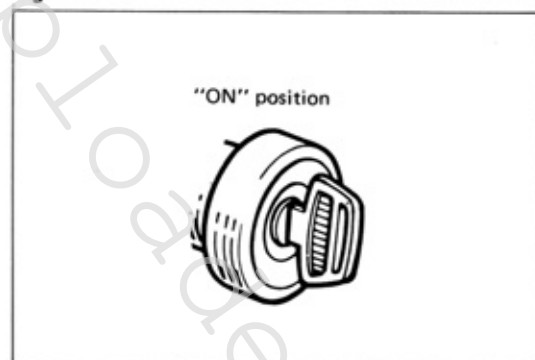
3. Before inserting the distributor, position the rotor and diaphragm as shown.

Fig. 10-57



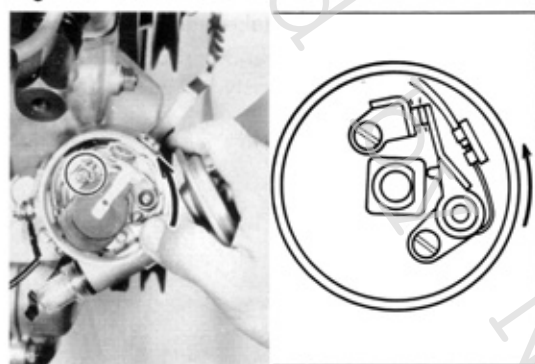
4. When fully installed, rotor should point toward as shown.

Fig. 10-58



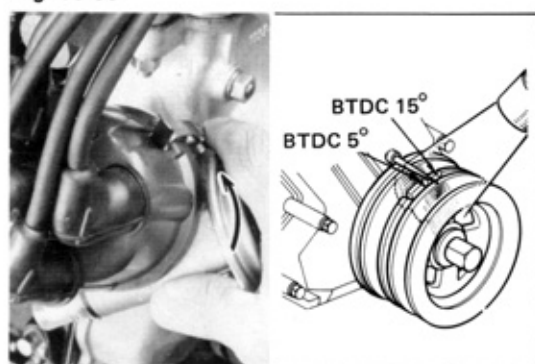
5. Turn ignition switch to ON position. Do not turn the starter motor.

Fig. 10-59



6. Rotate the distributor body counter-clockwise until when just sparking between points, then, tighten the clamp bolt in that position.

Fig. 10-60



7. Check ignition timing in idling condition.

Ignition timing

5° BTDC at coolant above 60°C

20° BTDC at coolant below 60°C

If necessary, align the timing marks by turning distributor body.

Fig. 10-61



Fig. 10-62

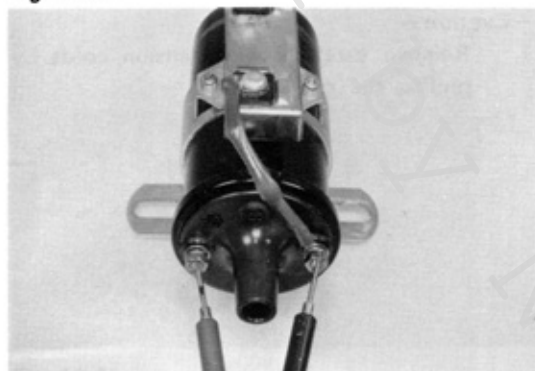


Fig. 10-63

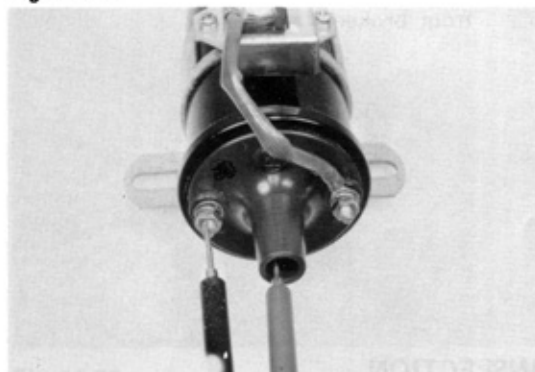
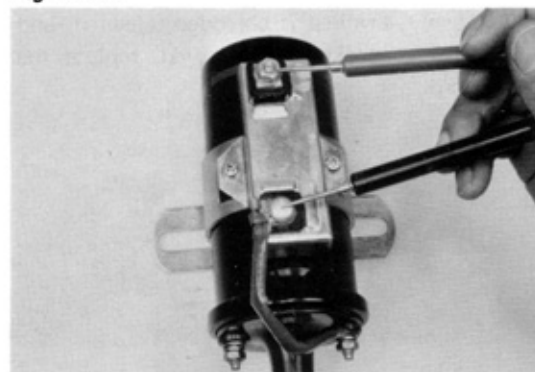


Fig. 10-64



IGNITION COIL INSPECTION



1. Clean the coil and inspect it for carbon paths around the terminals, and check the outside body for cracks.
2. Inspect the high tension cord insertion hole for carbon deposit or corrosion.



3. Measure the following resistances.
If the reading is not within the specified resistance replace coil.

Primary coil resistance (Reference only)
1.3 – 1.6 Ω

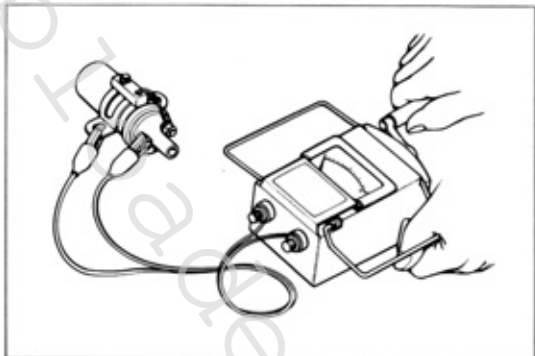


Secondary coil resistance (Reference only)
9.5 – 14.5 k Ω



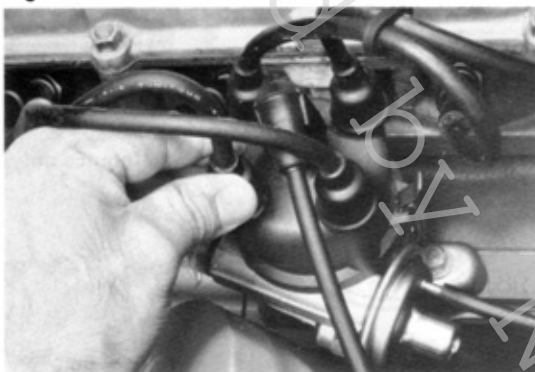
External resistor resistance (Reference only)
1.3-1.7 Ω

Fig. 10-65



Insulation resistance Over $10M\Omega$ at 500V

Fig. 10-66

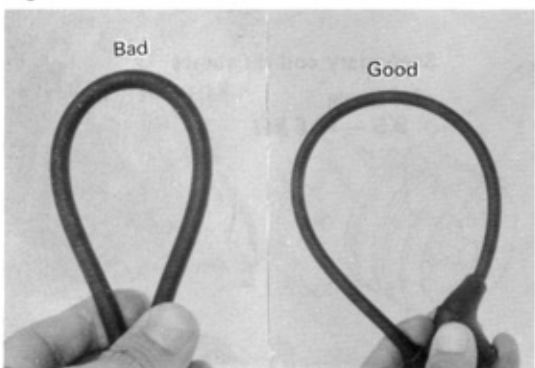


HIGH TENSION CORD

— Caution —

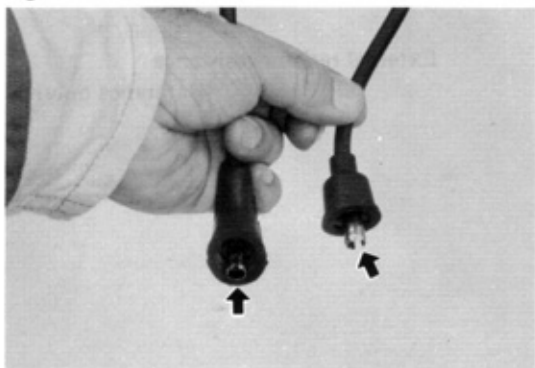
1. Remove carefully high tension cords by pulling the rubber boot.

Fig. 10-67



2. Do not bend cords so as to conductor from broken.

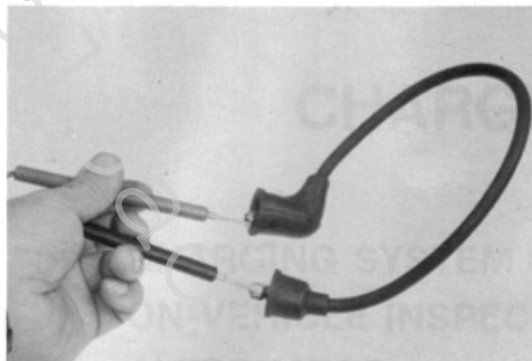
Fig. 10-68



INSPECTION

1. Check the condition of the cord terminal. If any terminal is corroded, clean it, and if it is broken or distorted, replace the cord.

Fig. 10-69



2. Check the resistance of each cord between both ends. If the reading exceeds the limit, replace the cord.

Resistance Less than 25 k Ω

Fig. 10-70



SPARK PLUG INSPECTION

Inspect for the following items. Clean or replace plugs if necessary.

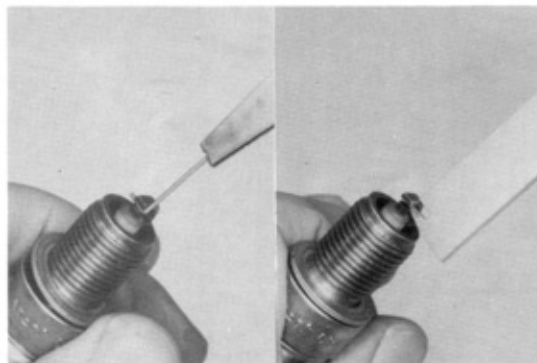
- Cracks or damages in the threads or insulator.
- Damaged or deteriorated gaskets.

Fig. 10-71



3. Wear on the electrodes.
4. Burnt condition of electrode and amount of carbon deposit.

Fig. 10-72



GAP ADJUSTMENT

Check the plug gap with plug gap gauge.
If not to specified value, adjust by bending the
ground (outer) electrode.

Spark plug gap 0.9 – 1.0 mm
(0.035 – 0.039 in)

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CHARGING SYSTEM

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| ALTERNATOR | |
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| INSPECTION AND REPAIR..... | 11—11 |
| ASSEMBLY | 11—14 |
| ALTERNATOR REGULATOR | |
| INSPECTION AND ADJUSTMENT | 11—19 |

CHARGING SYSTEM CIRCUIT

Fig. 11-1

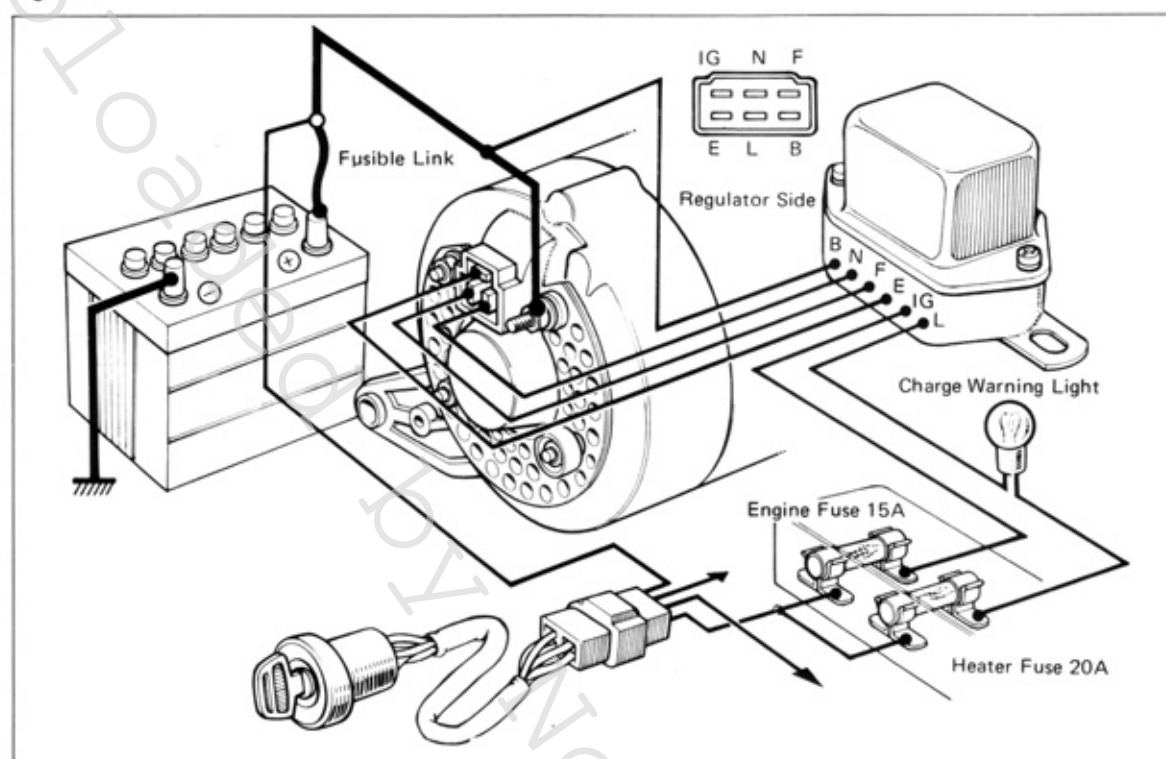


Fig. 11-2

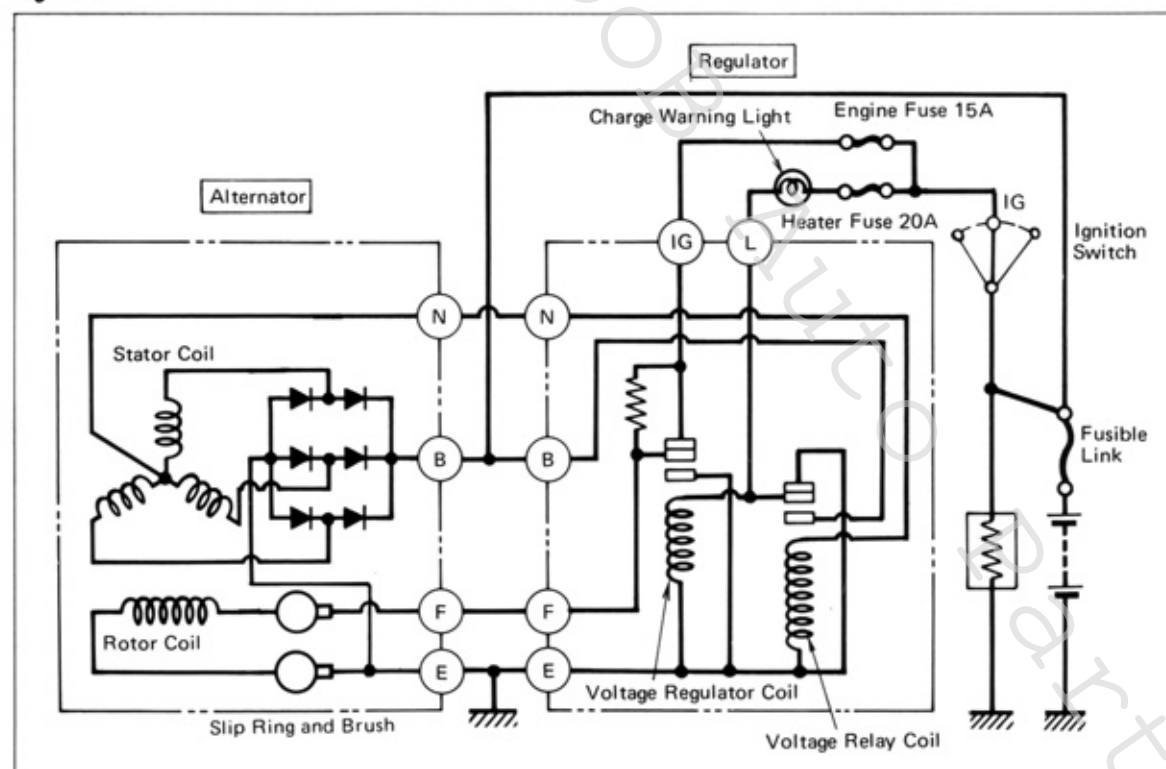
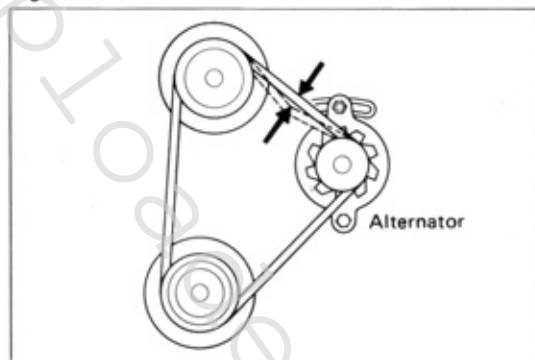


Fig. 11-3



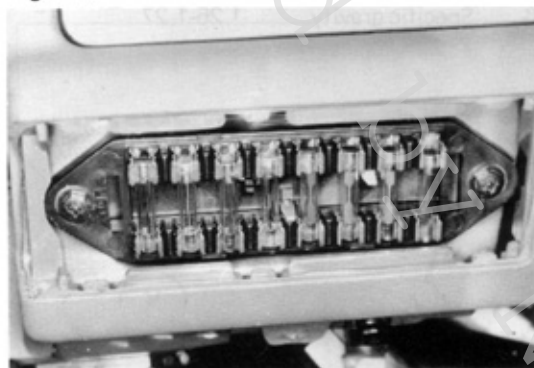
ON-VEHICLE INSPECTION



Inspect system components as follows.

1. Drive belt tension (at 10 kg)
8–12 mm (0.32–0.47 in)

Fig. 11-4



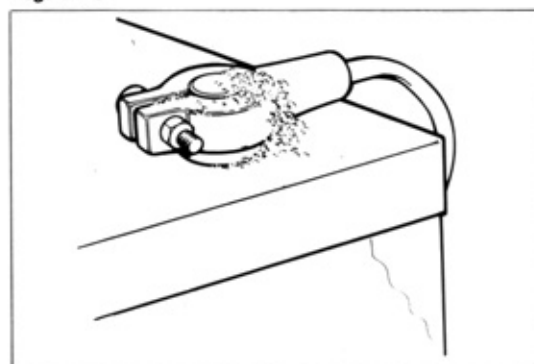
2. Fuses
Engine fuse 15A
Heater fuse 20A

Fig. 11-5



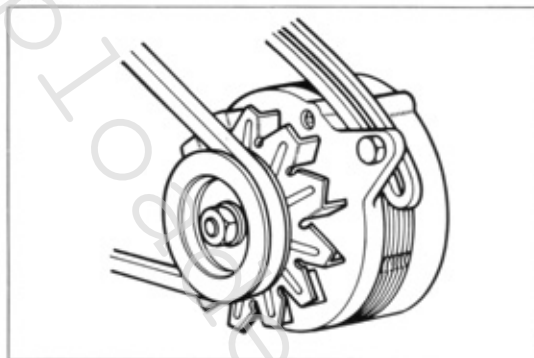
3. Installed condition of wiring for alternator and regulator.

Fig. 11-6



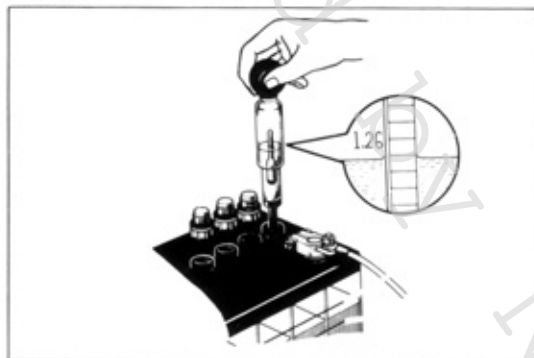
4. Battery terminal and fusible link
Loose
Corroded
Burnt

Fig. 11-7



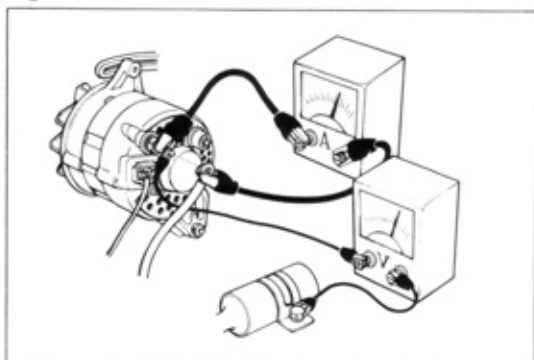
5. Alternator on-vehicle condition
Abnormal noise from alternator when engine is running.

Fig. 11-8



6. Specific gravity 1.25-1.27

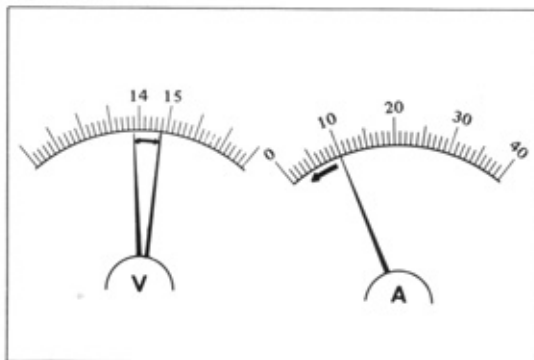
Fig. 11-9



PERFORMANCE TEST USING VOLT-METER AND AMMETER

Connect voltmeter and ammeter as illustrated, and switch off all accessory parts.

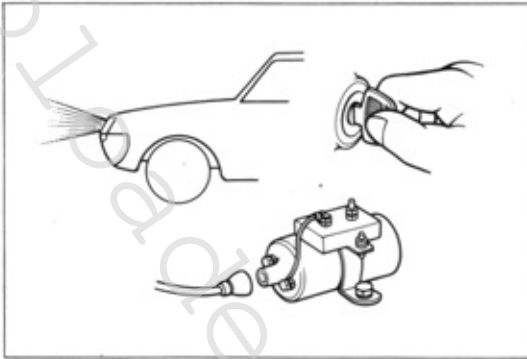
Fig. 11-10



No-load Performance test

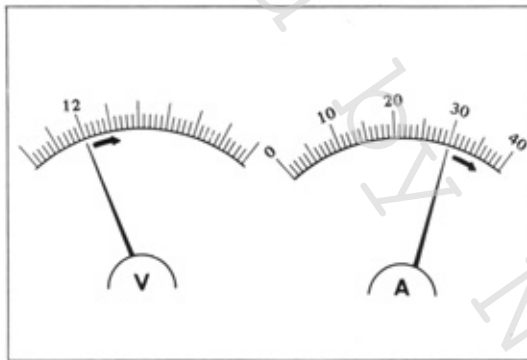
| | |
|-------------------|---------------------|
| Regulated voltage | 13.8 ~ 14.8 V |
| Current | Less than 10 A |
| Engine speed | Idling to 2000 rpm. |

Fig. 11-11

**Load Performance test**

1. Crank the engine with ignition coil high tension cord disconnected for about 5 to 10 seconds.
2. Turn on headlights and accessories.

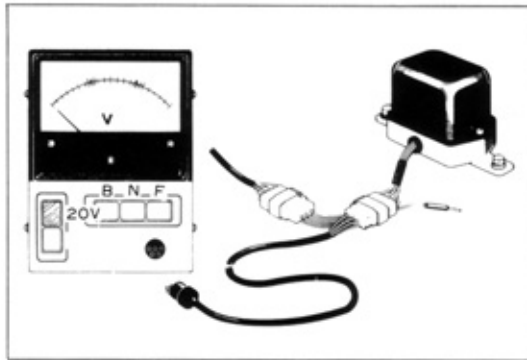
Fig. 11-12



3. Start engine, and run it at approximately 2000 rpm.

Regulated voltage**12 V****Current****More than 30 A**

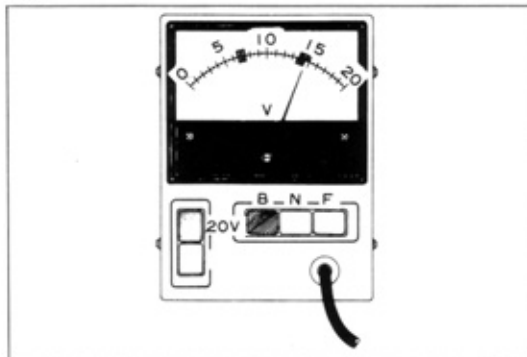
Fig. 11-13

**PERFORMANCE TEST BY ALTERNATOR CHECKER**

1. Unplug the alternator regulator connector and plug in the checker connector.

Push "20V" switch.

Fig. 11-14



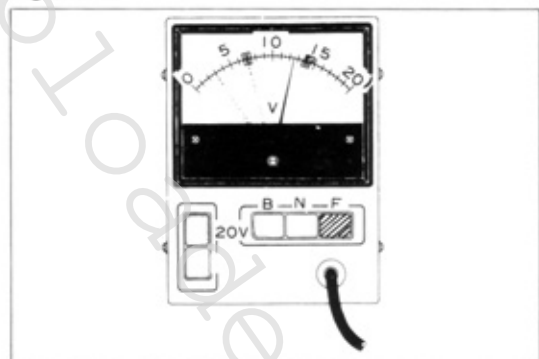
2. Check "B" terminal voltage.

Push "B" switch.

Raise engine speed from idling to 2000 rpm.

Standard voltage 13.8 to 14.8 V

Fig. 11-15

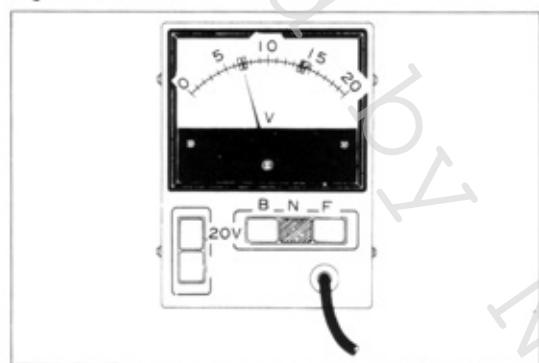


3. Check "F" terminal voltage.

Push "F" switch.

Gradually raise engine speed. The checker reading should gradually decrease from 12 volt to 3 volt.

Fig. 11-16

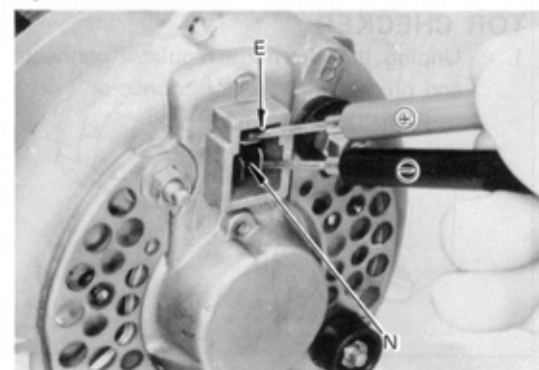


4. Check "N" terminal voltage.

Push "N" switch.

Maintain engine speed at approx. 1500 rpm. The pointer should be at a half of "B" terminal voltage.

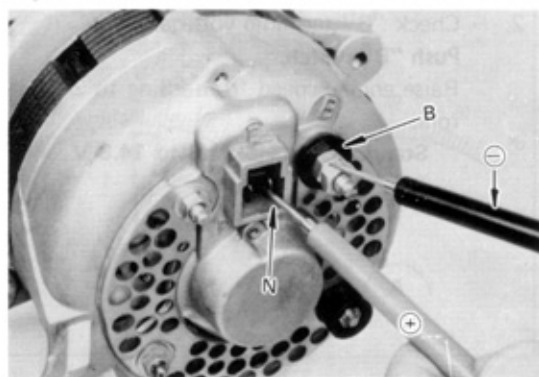
Fig. 11-17



ALTERNATOR INSPECTION

1. Negative side rectifier short test.
Connect an ohmmeter (-) lead to N terminal and (+) lead to E terminal.
Meter should indicate infinity.

Fig. 11-18



2. Positive side rectifier short test.
Connect an ohmmeter (-) lead to B terminal and (+) lead to N terminal.
Meter should indicate infinity.

Fig. 11-19

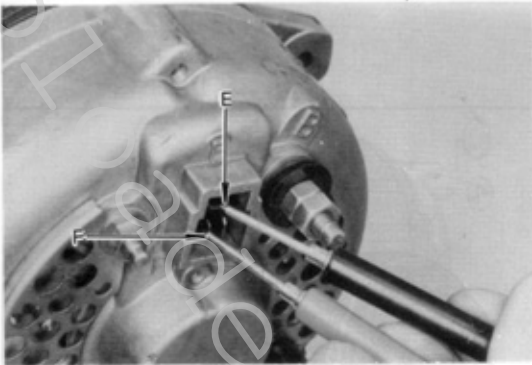
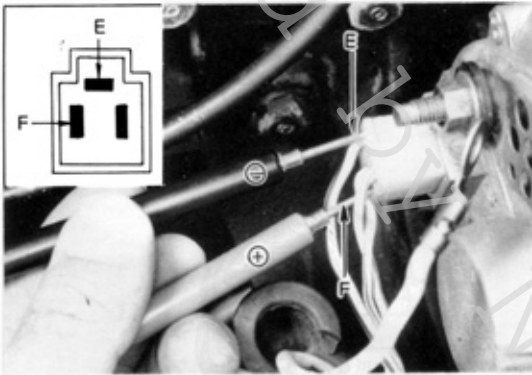


Fig. 11-20



3. Check rotor coil resistance.
Resistance 5-9 Ω



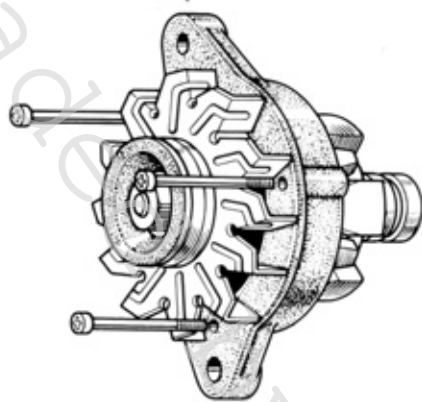
4. Turn ignition switch to ON position, and check if there is battery voltage at F terminal. If not, check ENGINE fuse.

ALTERNATOR

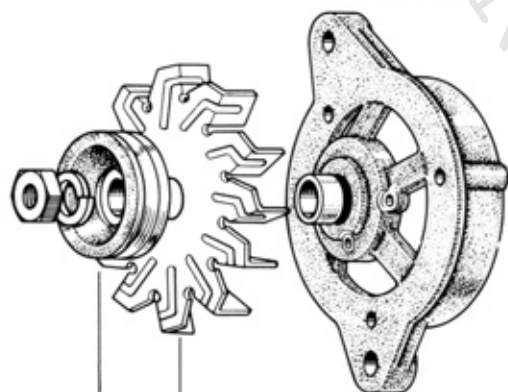
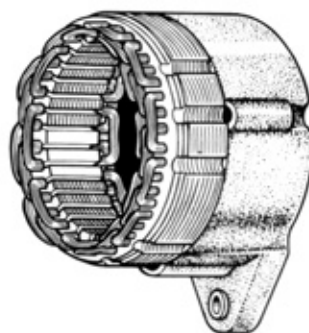
DISASSEMBLY

Disassemble in numerical order.

Fig. 11-21

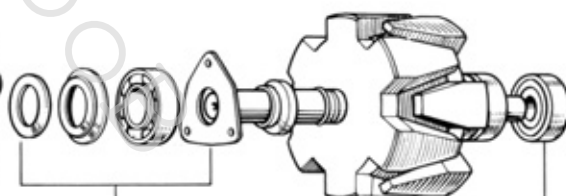


1
Fig. 11-23



2

5



3
Fig. 11-24

4
Fig. 11-25

- 1 Drive End Frame Assembly
- 2 Pulley and Fan
- 3 Rotor
- 4 Rear Bearing
- 5 Front Bearing

Fig. 11-22

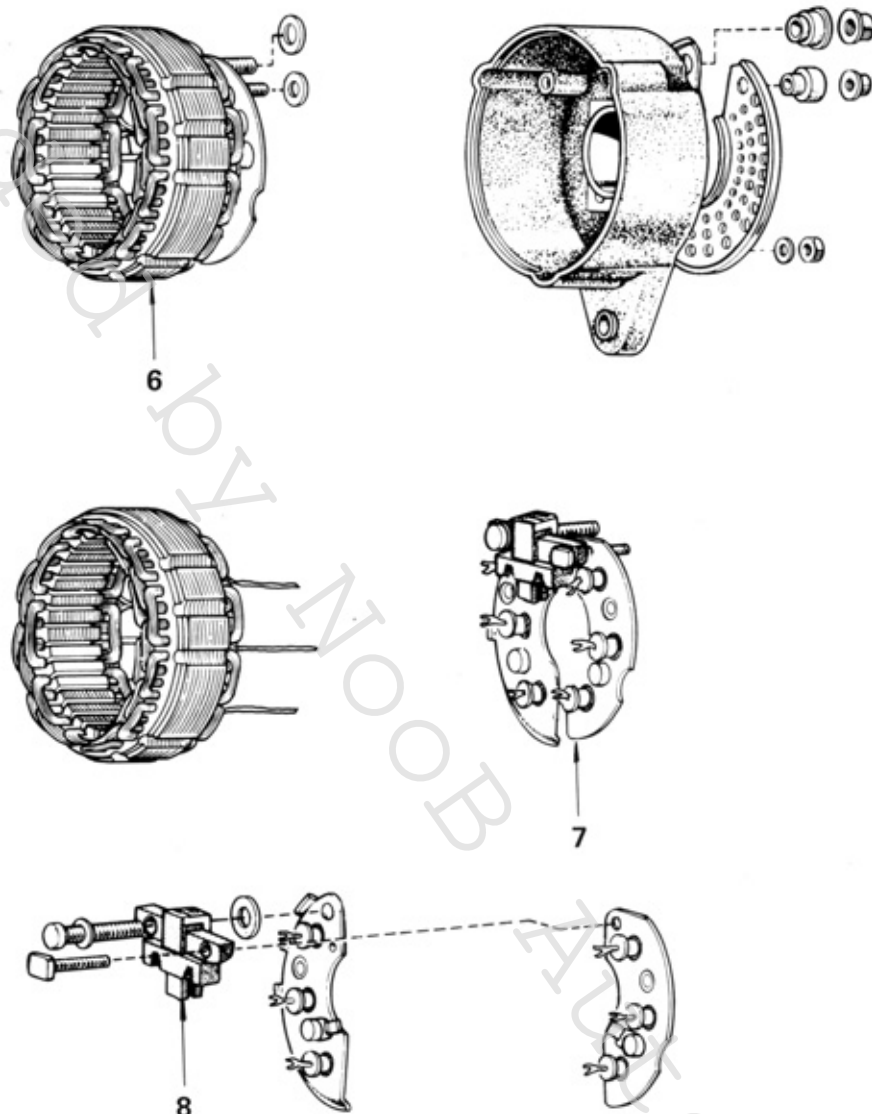
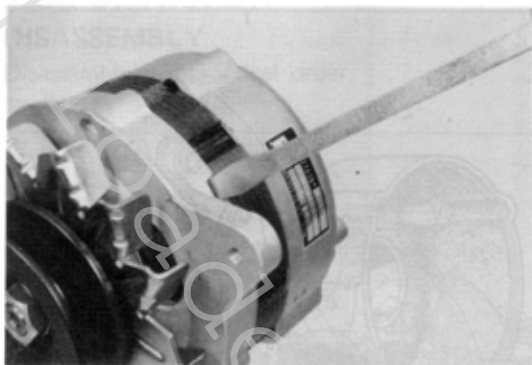


Fig. 11-26

- 6 Stator Coil and Rectifier Holder
- 7 Brush Holder and Rectifier Holder
- 8 Brush Holder

Fig. 11-23



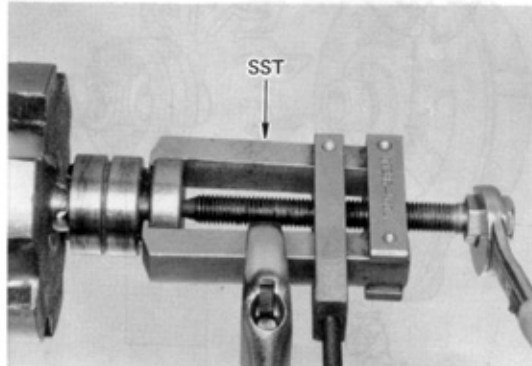
Pry drive end frame from stator.
Do not pry coil wires.

Fig. 11-24



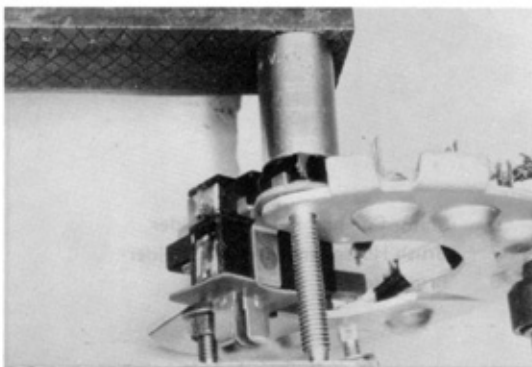
Remove rotor from drive end frame using a press.

Fig. 11-25



Remove rotor shaft rear bearing using SST [09286-46011].

Fig. 11-26



Remove brush holder assembly using a 10 mm socket wrench and vise.

Fig. 11-27

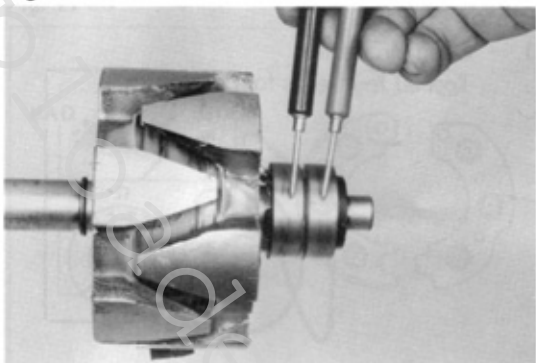


Fig. 11-28

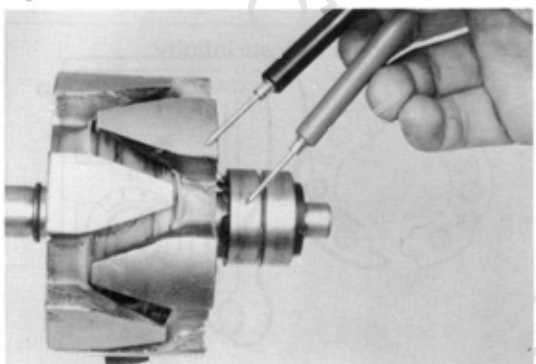


Fig. 11-29

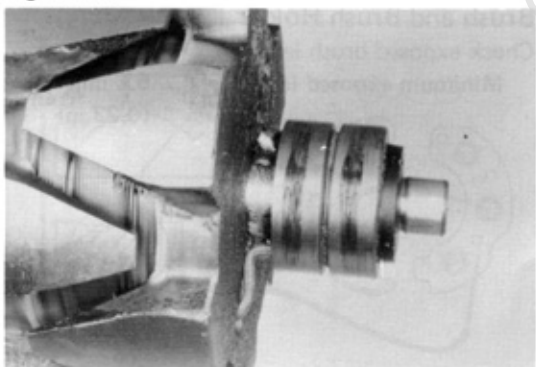
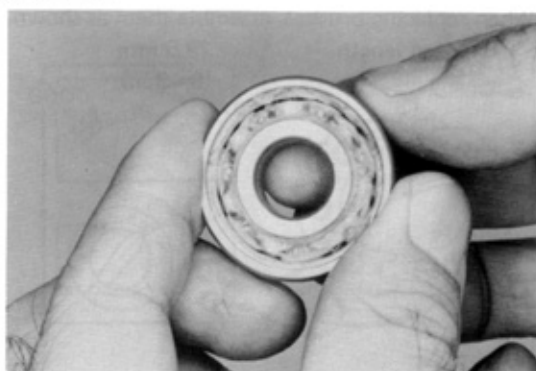


Fig. 11-30



INSPECTION AND REPAIR

Rotor

1. Open circuit test
Standard resistance 4.1-4.3 Ω



2. Ground test
Meter should indicate infinity.



3. Check slip ring for being dirty or burnt.

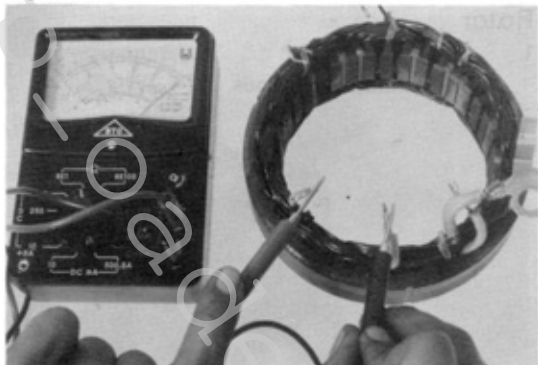


Bearing

- Check bearing for wear or roughness.

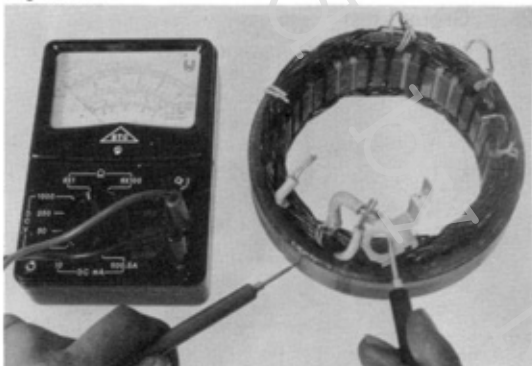


Fig. 11-31

**Stator**

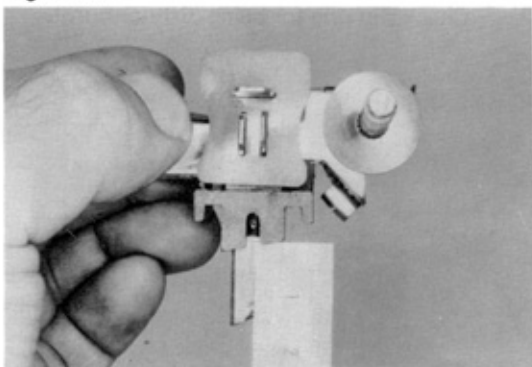
1. Open circuit test
Test all four leads for continuity.

Fig. 11-32



2. Ground test
Meter should indicate infinity.

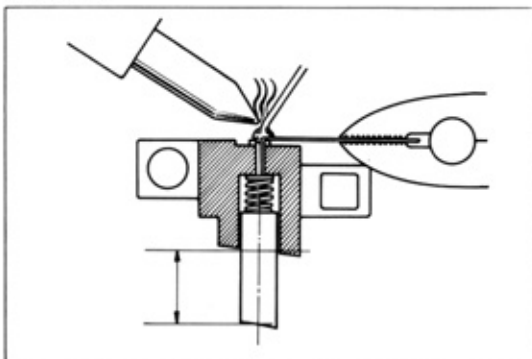
Fig. 11-33

**Brush and Brush Holder**

Check exposed brush length.
Minimum exposed length

**5.5 mm
(0.22 in)**

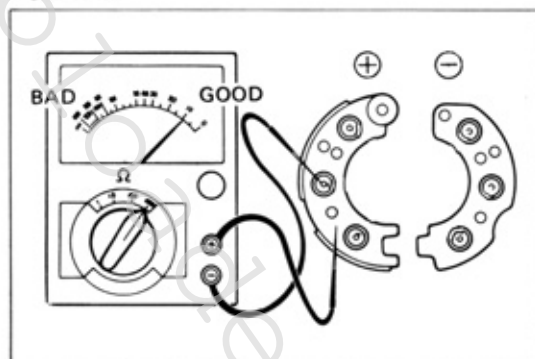
Fig. 11-34



When replacing brushes, assemble them as shown.

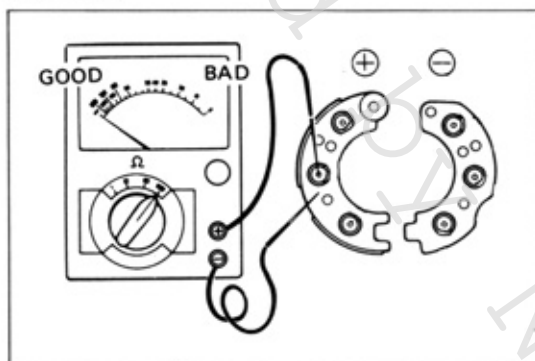
**Exposed length 12.5 mm
(0.49 in)**

Fig. 11-35

**Rectifier**

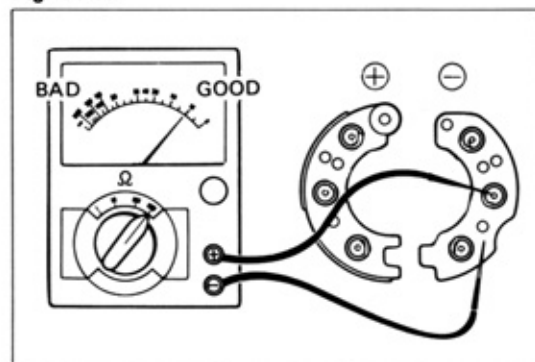
1. Rectifier holder positive side
Connect an ohmmeter (+) lead to the rectifier holder, and the (-) lead of the meter to the rectifier terminal. If there is no continuity, rectifier assembly must be replaced.

Fig. 11-36



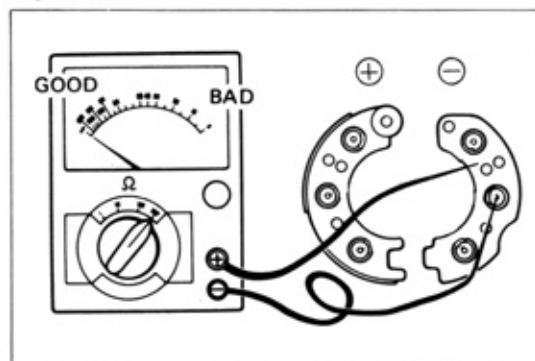
2. Reverse polarity of test leads and check again. If there is continuity, rectifier assembly must be replaced.

Fig. 11-37



3. Rectifier holder negative side
Connect an ohmmeter (+) lead to the rectifier terminal, and the (-) lead of the meter to the rectifier holder. If there is no continuity, rectifier assembly must be replaced.

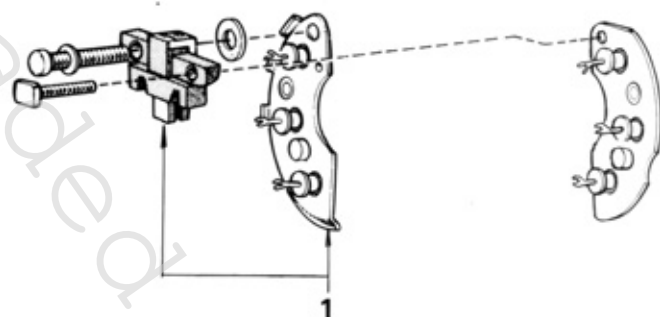
Fig. 11-38



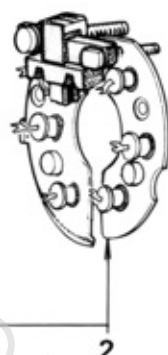
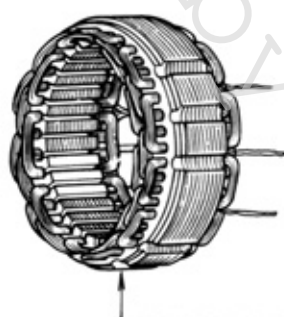
4. Reverse polarity of test leads and check again. If there is continuity, rectifier assembly must be replaced.

ASSEMBLY

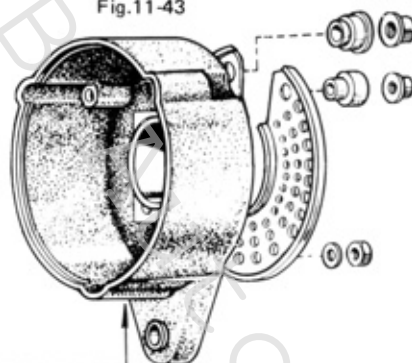
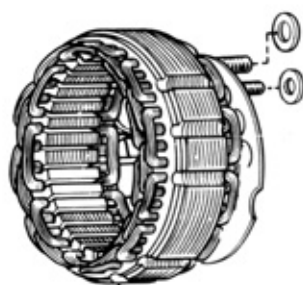
Assemble in numerical order.

Fig. 11-39

1
Fig.11-41
Fig.11-42



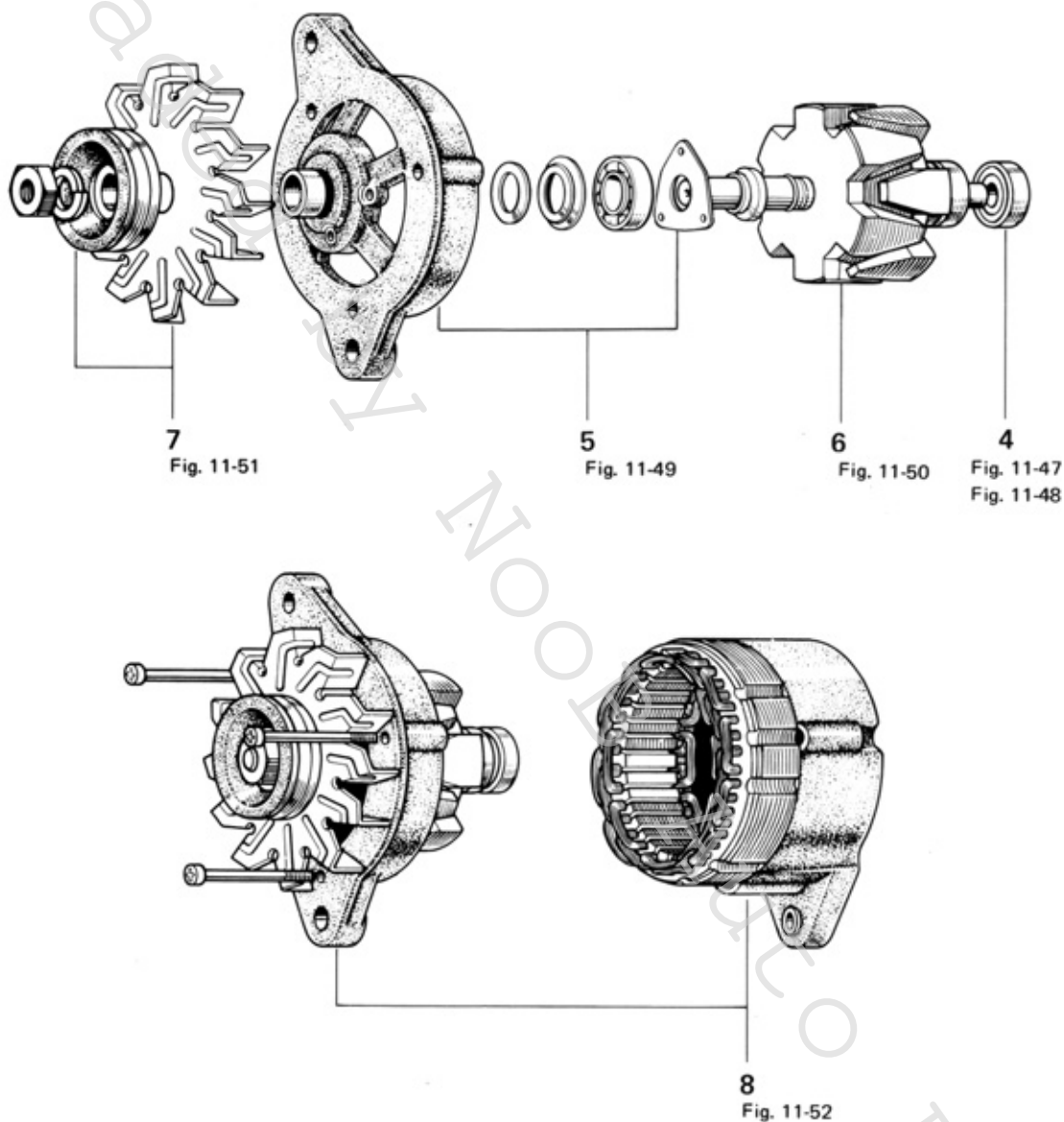
2
Fig.11-43



3
Fig.11-44
Fig.11-45
Fig.11-46

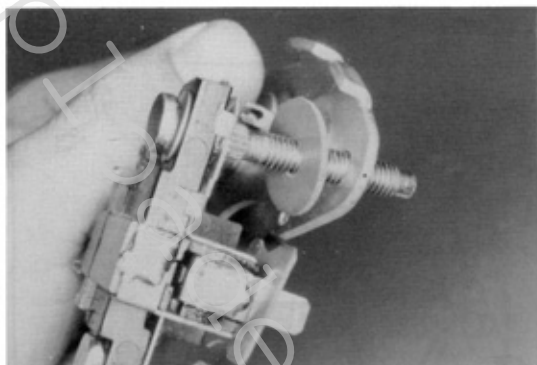
- 1 Brush Holder
- 2 Brush Holder and Rectifier Holder
- 3 Stator, Coil and Rectifier Holder

Fig. 11-40



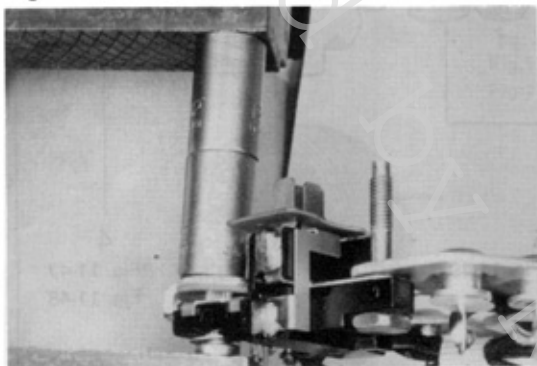
- 4 Rear Bearing
- 5 Front Bearing
- 6 Rotor
- 7 Pulley and Fan
- 8 Drive End Frame Assembly

Fig. 11-41



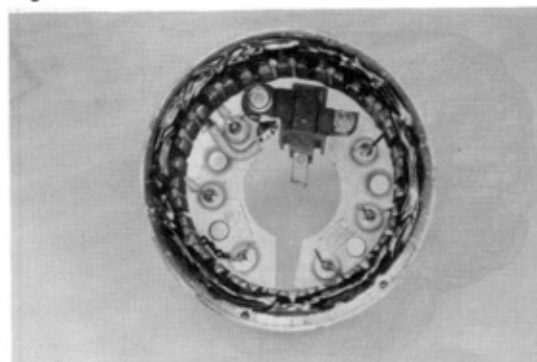
Insert insulator between positive rectifier holder and brush holder.

Fig. 11-42



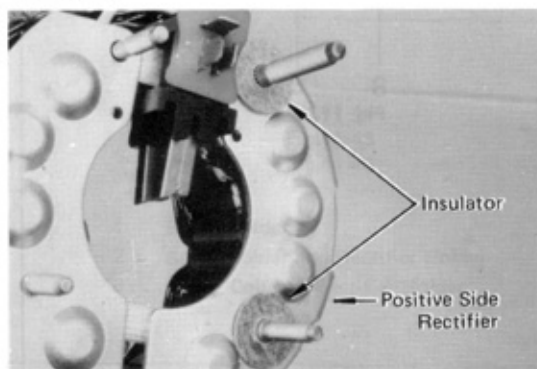
Install brush holder onto rectifier holder using socket wrench and a vise.

Fig. 11-43



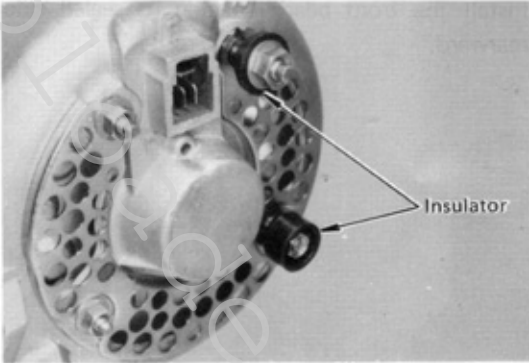
Connect stator coil "N" lead onto brush holder terminal, and solder each stator lead and rectifier lead to positive rectifier.

Fig. 11-44



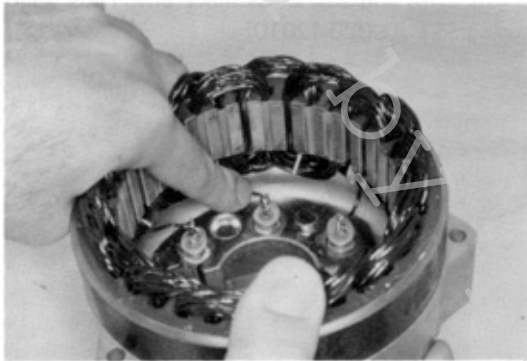
Assemble rear end frame and rectifier holder with insulators.

Fig. 11-45



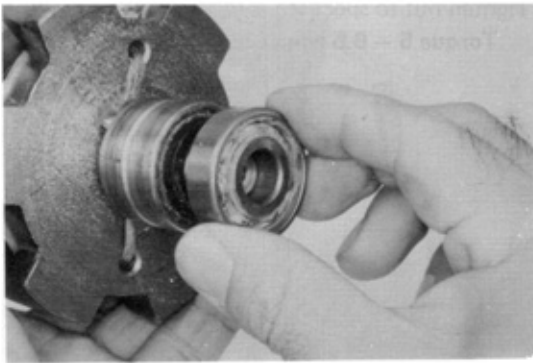
Assemble rear end cover with insulators.

Fig. 11-46



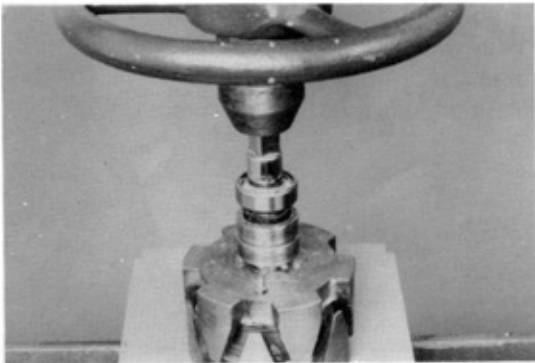
If there is danger of stator coil terminal wiring contacting on frame or rotor, correct by bending wiring.

Fig. 11-47



Install rear bearing facing its sealed side forward.

Fig. 11-48



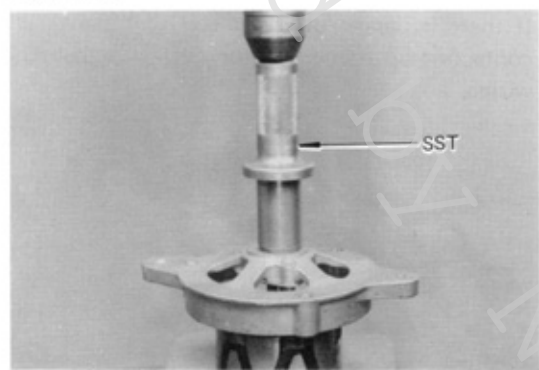
Press rear bearing onto rotor shaft, using a press.

Fig. 11-49



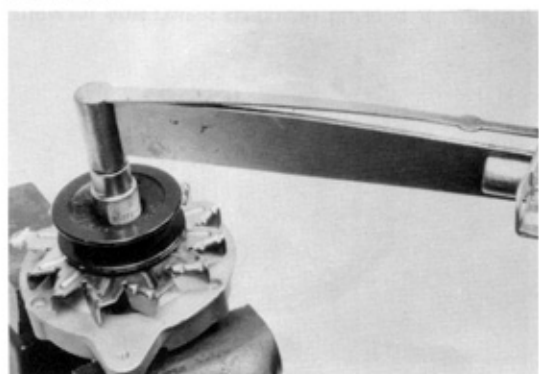
Install the front bearing facing its sealed side rearward.

Fig. 11-50



Press drive end frame assembly onto rotor shaft, using SST [09325-12010].

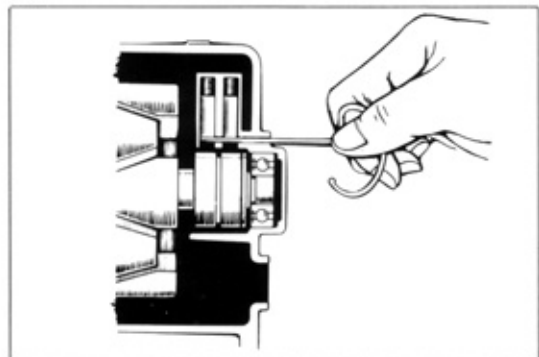
Fig. 11-51



Tighten nut to specified torque.

Torque 5 – 6.5 kg-m (36 – 47 ft-lb)

Fig. 11-52



Push in brushes and temporarily lock in place with wire inserted through access hole in end frame.

Position lead wires to clear rotor.

ALTERNATOR REGULATOR

Fig. 11-53

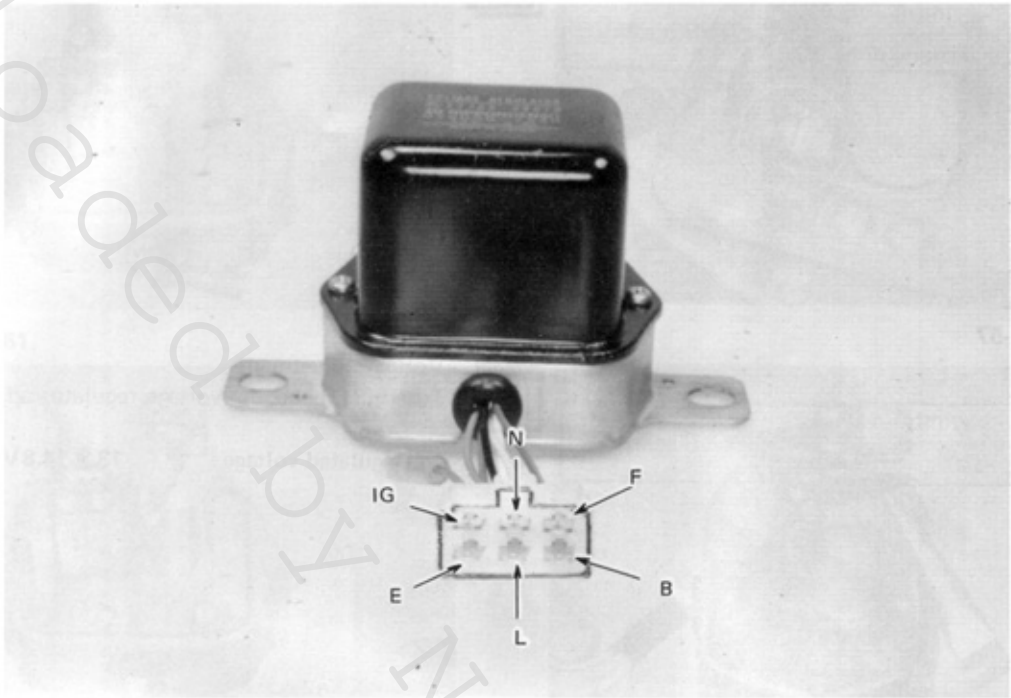
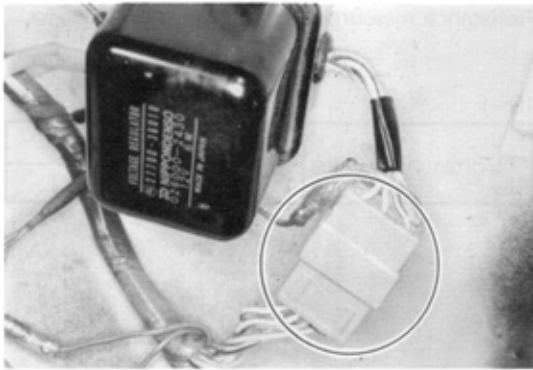


Fig. 11-54

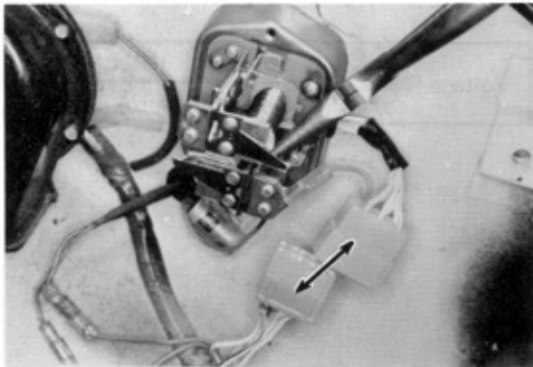


INSPECTION AND ADJUSTMENT



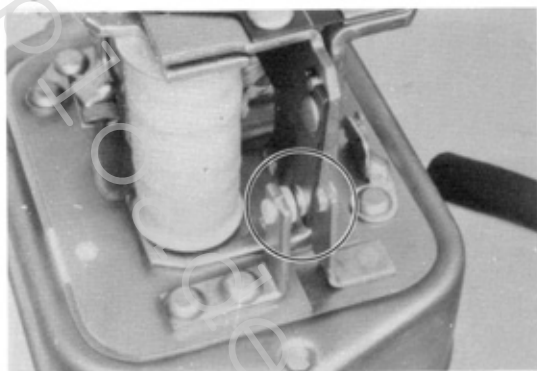
Check connector fitting condition before inspecting regulator.

Fig. 11-55



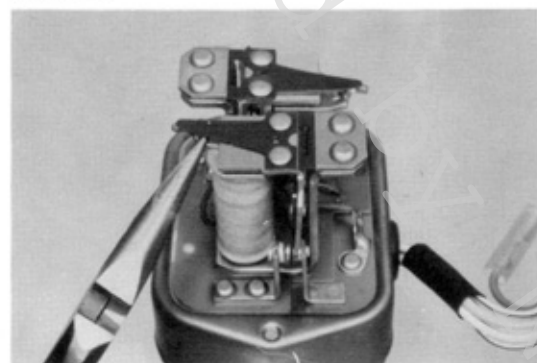
Always be sure to have the regulator connector pulled out when inspecting and adjusting.

Fig. 11-56



Inspect each point surface for burn or excessive damage. Replace if defective.

Fig. 11-57

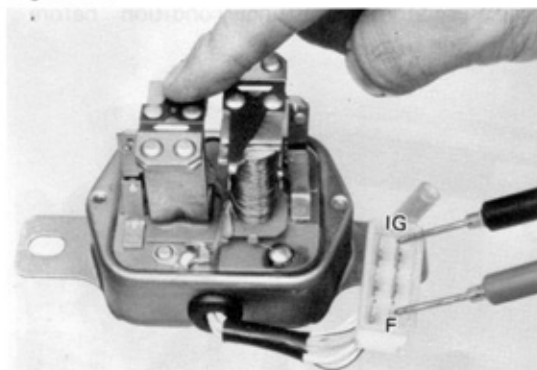


Voltage adjustment

To adjust, bend the voltage regulator adjusting arm.

Regulated voltage **13.8-14.8V**

Fig. 11-58

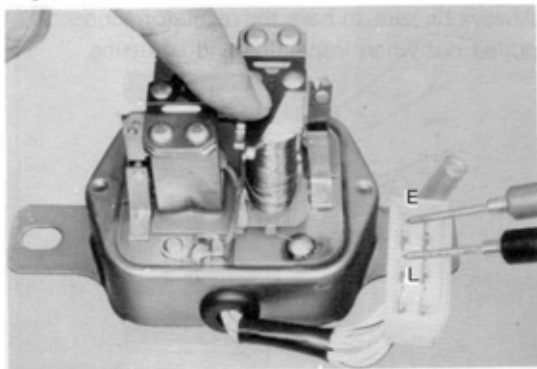


Resistance measurement between terminals.

IG-F

| | | |
|-------------------|-------------------|-----|
| Voltage Regulator | At rest | 0Ω |
| | Pulled in approx. | 11Ω |

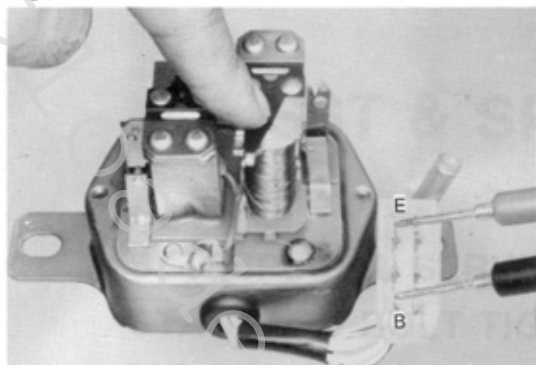
Fig. 11-59



L-E

| | | |
|---------------|-------------------|------|
| Voltage Relay | At rest | 0Ω |
| | Pulled in approx. | 100Ω |

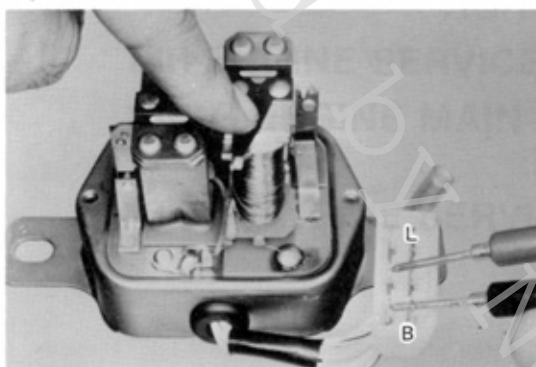
Fig. 11-60



B-E

| | | |
|---------------|-----------|--------------|
| Voltage Relay | At rest | infinity |
| | Pulled in | approx. 100Ω |

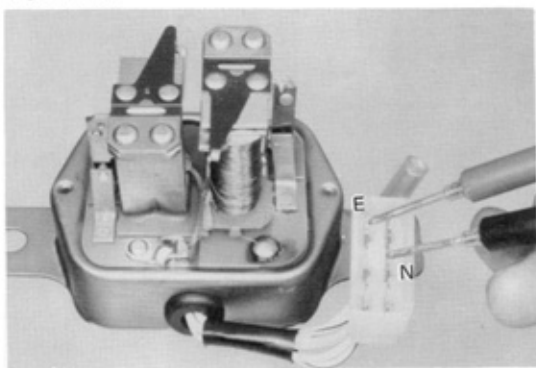
Fig. 11-61



B-L

| | | |
|---------------|-----------|----------|
| Voltage Relay | At rest | infinity |
| | Pulled in | 0Ω |

Fig. 11-62



N-E

approx. 25Ω














MEMO





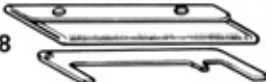








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SST & SPECIFICATION

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| 18R ENGINE SERVICE SPECIFICATION | ...12 – 6 |
| 18R-G ENGINE MAIN PART | |
| TIGHTENING TORQUE | ...12 – 14 |
| 18R-G ENGINE SERVICE SPECIFICATION | 12 – 14 |

SST (SPECIAL SERVICE TOOL)

| Illustration | Tool Number | 18R | 18R-G | Tool Name |
|--|-------------|-----------------------|-----------------------|--|
| 1  | 09081-00010 | <input type="radio"/> | <input type="radio"/> | Alternator Checker |
| 2  | 09201-60011 | <input type="radio"/> | <input type="radio"/> | Valve Stem Guide Remover & Replacer |
| 3  | 09202-43011 | <input type="radio"/> | <input type="radio"/> | Valve Spring Compressor |
| 4  | 09213-31021 | <input type="radio"/> | <input type="radio"/> | Crankshaft Pulley & Gear Puller |
| 5  | 09213-36010 | <input type="radio"/> | <input type="radio"/> | Timing Gear Remover |
| 6  | 09214-60010 | <input type="radio"/> | <input type="radio"/> | Crankshaft Pulley & Gear Replacer |
| 7  | 09222-30010 | <input type="radio"/> | <input type="radio"/> | Connecting Rod Bushing Remover & Replacer |
| 8  | 09223-41010 | <input type="radio"/> | <input type="radio"/> | Crankshaft Rear Oil Seal Replacer |
| 9  | 09223-50010 | <input type="radio"/> | <input type="radio"/> | Crankshaft Front Oil Seal Replacer |
| 10  | 09228-22020 | <input type="radio"/> | <input type="radio"/> | Oil Filter Wrench |
| 11  | 09228-34010 | <input type="radio"/> | <input type="radio"/> | |
| 12  | 09233-33010 | <input type="radio"/> | <input type="radio"/> | Pump Drive Shaft Bearing Replacer |
| 13  | 09236-36010 | <input type="radio"/> | <input type="radio"/> | Water Pump Overhaul Tool (For Fluid Coupling Service) |

| Illustration | Tool Number | 18R | 18R-G | Tool Name |
|--|-------------|-----------------------|-----------------------|---|
| 14  | 09240-00014 | <input type="radio"/> | <input type="radio"/> | Carburetor Adjusting Gauge Set |
| 15  | 09240-00020 | <input type="radio"/> | <input type="radio"/> | Wire Gauge Set |
| 16  | 09240-27010 | | <input type="radio"/> | Float Level Gauge |
| 17  | 09243-00010 | <input type="radio"/> | <input type="radio"/> | Idle Mixture Adjusting Screw Wrench |
| 18  | 09248-27010 | | <input type="radio"/> | Valve Timing Adjusting Gauge |
| 19  | 09286-46011 | <input type="radio"/> | <input type="radio"/> | Injection Pump Spline Shaft Puller (For Alternator Service) |
| 20  | 09303-35010 | <input type="radio"/> | <input type="radio"/> | Input Shaft Front Bearing Puller |
| 21  | 09304-30012 | <input type="radio"/> | <input type="radio"/> | Input Shaft Front Bearing Replacer |
| 22  | 09308-10010 | <input type="radio"/> | <input type="radio"/> | Oil Seal Puller |
| 23  | 09325-12010 | <input type="radio"/> | <input type="radio"/> | Transmission Oil Plug (For Alternator Service) |
| 24  | 09816-30010 | <input type="radio"/> | <input type="radio"/> | Oil Pressure Switch Socket |
| 25  | 09860-11011 | <input type="radio"/> | <input type="radio"/> | Carburetor Drive Set |
| 26  | 09992-00010 | | <input type="radio"/> | Dual Vacuum Gauge |

STANDARD BOLT TIGHTENING TORQUE

STANDARD BOLT CLASSIFICATION

| Class | Basic Dia. | Pitch | Standard Torque | | Torque Limit | |
|-------|------------|------------|-----------------|-------|--------------|--------------|
| | | | kg-m | ft-lb | kg-m | ft-lb |
| 4T | 6 | 1 | 0.47 | 3.4 | 0.4 – 0.7 | 2.9 – 5.1 |
| | 8 | 1.25 | 1.11 | 8.0 | 1.0 – 1.6 | 7.2 – 11.6 |
| | 10 | 1.25 | 2.25 | 16.3 | 1.9 – 3.1 | 13.7 – 22.4 |
| | 10 | 1.5 | 2.14 | 15.5 | 1.8 – 3.0 | 13.0 – 21.7 |
| | 12 | 1.25 (ISO) | 4.40 | 31.8 | 3.5 – 5.5 | 25.3 – 39.8 |
| | 12 | 1.5 | 3.89 | 28.1 | 3.5 – 5.0 | 25.3 – 36.2 |
| | 12 | 1.75 | 3.74 | 27.0 | 3.0 – 5.0 | 21.7 – 36.2 |
| | 13 | 1.5 | 5.08 | 36.8 | 4.5 – 7.0 | 32.5 – 50.6 |
| | 14 | 1.5 | 6.33 | 45.8 | 5.0 – 8.0 | 36.2 – 57.9 |
| | 14 | 2 | 5.93 | 42.8 | 4.7 – 7.7 | 34.0 – 55.7 |
| | 16 | 1.5 | 9.57 | 69.2 | 7.5 – 11.0 | 54.2 – 79.6 |
| | 16 | 2 | 9.10 | 65.8 | 7.1 – 10.6 | 51.3 – 76.7 |
| 5T | 6 | 1 | 0.71 | 5.1 | 0.6 – 0.9 | 4.3 – 6.5 |
| | 8 | 1.25 | 1.66 | 12.0 | 1.5 – 2.2 | 10.9 – 15.9 |
| | 10 | 1.25 | 3.34 | 24.1 | 3.0 – 4.5 | 21.7 – 32.5 |
| | 10 | 1.5 | 3.22 | 23.3 | 2.7 – 4.2 | 19.5 – 30.4 |
| | 12 | 1.25 (ISO) | 6.60 | 47.7 | 5.0 – 8.0 | 36.2 – 57.9 |
| | 12 | 1.5 | 5.84 | 42.2 | 5.0 – 7.0 | 36.2 – 50.6 |
| | 12 | 1.75 | 5.61 | 40.6 | 4.8 – 6.8 | 34.7 – 49.2 |
| | 13 | 1.5 | 7.63 | 55.2 | 6.5 – 9.0 | 47.0 – 65.1 |
| | 14 | 1.5 | 9.50 | 68.7 | 7.5 – 11.0 | 54.2 – 79.6 |
| | 14 | 2 | 8.90 | 65.3 | 7.0 – 10.5 | 50.6 – 75.9 |
| | 16 | 1.5 | 14.36 | 103.8 | 12.0 – 17.0 | 86.8 – 123.0 |
| | 16 | 2 | 13.58 | 98.1 | 11.5 – 16.5 | 83.2 – 119.2 |
| 6T | 6 | 1 | 0.71 | 5.1 | 0.6 – 0.9 | 4.3 – 6.5 |
| | 8 | 1.25 | 1.66 | 12.0 | 1.5 – 2.2 | 10.9 – 15.9 |
| | 10 | 1.25 | 3.37 | 24.0 | 3.0 – 4.5 | 21.7 – 32.5 |
| | 10 | 1.5 | 3.20 | 23.1 | 2.7 – 4.2 | 19.5 – 30.4 |
| | 12 | 1.25 (ISO) | 6.60 | 47.7 | 5.0 – 8.0 | 36.2 – 57.9 |
| | 12 | 1.5 | 5.84 | 42.2 | 5.0 – 7.0 | 36.2 – 50.6 |
| | 12 | 1.75 | 5.61 | 40.6 | 4.8 – 6.8 | 34.7 – 49.2 |

| Class | Basic Dia. | Pitch | Standard Torque | | Torque Limit | |
|-------|------------|------------|-----------------|-------|--------------|---------------|
| | | | kg-m | ft-lb | kg-m | ft-lb |
| 7T | 6 | 1 | 0.95 | 6.5 | 0.8 – 1.2 | 5.8 – 8.6 |
| | 8 | 1.25 | 2.21 | 16.1 | 2.0 – 3.0 | 14.5 – 21.7 |
| | 10 | 1.25 | 4.49 | 32.5 | 4.0 – 5.5 | 28.9 – 39.8 |
| | 10 | 1.5 | 4.29 | 31.0 | 3.7 – 5.2 | 26.8 – 37.6 |
| | 12 | 1.25 (ISO) | 8.80 | 63.6 | 7.5 – 10.5 | 54.2 – 75.9 |
| | 12 | 1.5 | 7.78 | 56.2 | 7.0 – 9.0 | 50.6 – 65.1 |
| | 12 | 1.75 | 7.48 | 54.1 | 6.0 – 8.5 | 43.3 – 61.4 |
| | 13 | 1.5 | 10.17 | 73.5 | 8.0 – 12.0 | 57.9 – 86.8 |
| | 14 | 1.5 | 12.67 | 91.6 | 10.0 – 15.0 | 72.3 – 108.5 |
| | 14 | 2 | 11.86 | 85.8 | 9.5 – 14.0 | 68.7 – 101.2 |
| | 16 | 1.5 | 19.15 | 138.5 | 15.0 – 23.0 | 108.5 – 166.2 |
| | 16 | 2 | 18.11 | 131.0 | 14.0 – 22.0 | 101.2 – 159.0 |

Note: The above specified tightening torque is applicable only for female threads cut into a steel material.

If the female threads are cut in other materials than steel, and also tightening surface are encountered to heat or vibrations, these specified tightening torque must be reconsidered.

16R-18R ENGINE MAIN PART TIGHTENING TORQUE

| Tightening Part | | | Tightening Torque | |
|------------------------|------------|--|-------------------|-------------|
| | | | kg-m | ft-lb |
| Cylinder head | 13 mm bolt | | 10.0 – 12.0 | 72.3 – 86.8 |
| Valve rocker support | | | 1.7 – 2.3 | 12.3 – 16.6 |
| Manifold | | | 4.5 – 5.5 | 32.6 – 39.8 |
| Camshaft bearing cap | | | 1.7 – 2.3 | 12.3 – 16.6 |
| Camshaft timing gear | | | 1.7 – 2.3 | 12.3 – 16.6 |
| Camshaft drive gear | | | 8.0 – 10.0 | 57.7 – 72.3 |
| Crankshaft bearing cap | | | 9.5 – 11.5 | 68.7 – 83.2 |
| Connecting rod cap | | | 5.4 – 6.6 | 39.1 – 47.7 |
| Oil pan | | | 0.4 – 0.8 | 2.9 – 5.8 |
| Crankshaft pulley | | | 9.5 – 11.0 | 68.7 – 79.6 |
| Flywheel | 18R | | 7.5 – 8.5 | 54.3 – 61.5 |
| | 16R | | 8.0 – 9.0 | 57.7 – 65.1 |
| Thermo switch | | | 3.0 – 4.0 | 21.7 – 28.9 |

18R SERVICE SPECIFICATION

18R ENGINE TUNE-UP

| | | |
|--|----------------------------------|----------------------|
| Drive belt tension at 10 kg (22 lb) | | |
| Fan — Alternator | 8 — 12 mm | 0.31 — 0.47 in |
| A/C Compressor — Crankshaft | 15 — 18 mm | 0.59 — 0.71 in |
| Battery specific gravity at 20°C (70°F) | 1.25 — 1.27 | |
| Engine oil capacity | | |
| RT Total | 5.0 Liter | 5.3 US qt 4.4 Imp.qt |
| Crankcase | 3.8 Liter | 4.0 US qt 3.3 Imp.qt |
| RA Total | 4.7 Liter | 5.0 US qt 4.1 Imp.qt |
| Crankcase | 3.8 Liter | 4.0 US qt 3.3 Imp.qt |
| RX Total | 5.0 Liter | 5.3 US qt 4.4 Imp.qt |
| Crankcase | 3.9 Liter | 4.1 US qt 3.4 Imp.qt |
| RN Total | 5.0 Liter | 5.3 US qt 4.4 Imp.qt |
| Crankcase | 4.1 Liter | 4.3 US qt 3.6 Imp.qt |
| Coolant capacity (w/heater) | 8.0 Liter | 8.5 US qt 7.5 Imp.qt |
| Spark plug heat range | | |
| ND | W20EPR (for ECE) | W20EP |
| NGK | BPR6ES (for ECE) | BP6ES |
| Spark plug gap | 0.8 mm | 0.03 in |
| Distributor | | |
| Dwell angle | 50 — 54° | |
| Point gap | 0.4 — 0.5 mm | 0.016 — 0.020 in |
| Damping spring gap | 0.1 — 0.4 mm | 0.004 — 0.168 in |
| Ignition timing | 7° BTDC/650 rpm | |
| Firing order | 1 — 3 — 4 — 2 | |
| Valve clearance (Hot) | | |
| Intake | 0.20 mm | 0.0079 in |
| Exhaust | 0.36 mm | 0.0141 in |
| Initial idle speed | | |
| Manual transmission | 750 ± 50 rpm | |
| Manifold vacuum (at idle speed) | | |
| Manual transmission | More than 420 mm Hg | 16.5 in Hg |
| Automatic transmission | More than 350 mm Hg | 13.8 in Hg |
| CO Concentration | 1—3 % | |
| Fast idle speed | 2600 ± 200 rpm | |
| Compression pressure (at 250 rpm) | | |
| STD | 12.0 kg/cm ² | 170.0 psi |
| Limit | 9.0 kg/cm ² | 127.8 psi |
| Difference of pressure between cylinders | Less than 1.0 kg/cm ² | 14.2 psi |

18R ENGINE**Cylinder Head**

| | | | |
|-----------------------|--------------------------|-----------------------|------------------|
| Surface warpage limit | | 0.05 mm | 0.0019 in |
| Valve | Contacting surface angle | 45° | |
| | Contacting width | 1.2 – 1.6 mm | 0.047 – 0.063 in |
| | Refacing angle | 30° 45° 60° | |

Valve Guide Bushing

| | | | |
|-------------------------------|----------|------------------|--------------------|
| Inner diameter | | 8.01 – 8.03 mm | |
| Outer diameter | STD | 14.02 – 14.04 mm | 0.5513 – 0.5528 in |
| | O/S 0.05 | 14.07 – 14.09 mm | 0.5548 – 0.5551 in |
| Projection from cylinder head | | 15.8 – 16.2 mm | 0.622 – 0.638 in |

Valve

| | | | |
|----------------------------------|---------------------------|------------------|--------------------|
| Valve overall length limit | | 112.7 mm | 4.437 in |
| | (Both intake and exhaust) | | |
| Valve head contacting face angle | | 45° | |
| Valve stem diameter | Intake | 7.970 – 7.985 mm | 0.3138 – 0.3144 in |
| | Exhaust | 7.960 – 7.975 mm | 0.3139 – 0.3140 in |
| Valve stem oil clearance | Intake | 0.03 – 0.06 mm | 0.0012 – 0.0024 in |
| | Exhaust | 0.04 – 0.08 mm | 0.0016 – 0.0032 in |
| | Limit Intake | 0.08 mm | 0.0032 in |
| | Exhaust | 0.10 mm | 0.0039 in |
| Valve head thickness limit | | | |
| | (Both intake and exhaust) | 0.6 mm | 0.024 in |

Valve Spring

| | | | |
|-------------------|-------------|---------|----------|
| Free length | Inner | 44.1 mm | 1.736 in |
| | Outer | 46.5 mm | 1.830 in |
| Installed length | Inner | 37.5 mm | 1.476 in |
| | Outer | 41.5 mm | 1.634 in |
| Installed Tension | STD Inner | 6.9 kg | 15.21 lb |
| | Outer | 23.0 kg | 50.71 lb |
| | Limit Inner | 6.0 kg | 13.23 lb |
| | Outer | 19.0 kg | 41.89 lb |
| Squareness | Limit Inner | 1.6 mm | 0.063 in |
| | Outer | 1.9 mm | 0.075 in |

Camshaft

| | | | | |
|-----------------------|-------|---------|------------------|--------------------|
| Bent limit | | | 0.10 mm | 0.004 in |
| Thrust clearance | STD | | 0.04 – 0.17 mm | 0.0056 – 0.0067 in |
| | Limit | | 0.25 mm | 0.0098 in |
| Journal oil clearance | STD | | 0.03 – 0.06 mm | 0.0012 – 0.0024 in |
| | Limit | | 0.1 mm | 0.0039 in |
| Journal diameter | | | 34.97 – 35.00 mm | 1.3768 – 1.3780 in |
| Bearing U/S Type | | | 0.125, 0.25 | |
| Cam height | STD | Intake | 44.04 mm | 1.7339 in |
| | | Exhaust | 44.14 mm | 1.7378 in |
| | Limit | Intake | 43.7 mm | 1.720 in |
| | | Exhaust | 43.8 mm | 1.724 in |

Valve Rocker Arm and Shaft

| | | | | |
|---------------|-------|--|----------------|--------------------|
| Oil clearance | STD | | 0.02 – 0.05 mm | 0.0008 – 0.0020 in |
| | Limit | | 0.08 mm | 0.0032 in |

Manifold

| | | | |
|--------------------------------|--|--------|----------|
| Manifold surface warpage limit | | 0.4 mm | 0.016 in |
|--------------------------------|--|--------|----------|

Timing Chain

| | | | |
|------------------|-----------------|----------|----------|
| Elongation limit | No.1 | 291.4 mm | 11.47 in |
| | No.2 (17 Links) | 147.0 mm | 5.79 in |

Timing Gear

| | | | |
|------------|-----------------------|----------|----------|
| Wear limit | Crankshaft gear | 60.0 mm | 2.362 in |
| | Pump drive shaft gear | 114.5 mm | 4.508 in |
| | Camshaft drive gear | 78.2 mm | 3.079 in |
| | Camshaft timing gear | 78.2 mm | 3.079 in |

Chain Tensioner and Vibration Damper

| | | | |
|------------|-------------------|---------|---------|
| Wear limit | No.1 tensioner | 11.5 mm | 0.45 in |
| | No.1 damper | 5.0 mm | 0.20 in |
| | No.2 damper | 5.0 mm | 0.20 in |
| | Tensioner slipper | 6.8 mm | 0.26 in |

Pump Drive Shaft and Bearing

| | | | |
|---------------------------|-------|------------------|--------------------|
| Thrust clearance | STD | 0.06 – 0.13 mm | 0.0024 – 0.0051 in |
| | Limit | 0.3 mm | 0.012 in |
| Journal diameter | Front | 45.96 – 45.98 mm | 1.8098 – 1.8106 in |
| | Rear | 40.96 – 40.98 mm | 1.6126 – 1.6134 in |
| Oil clearance | STD | 0.03 – 0.07 mm | 0.0012 – 0.0028 in |
| | Limit | 0.08 mm | 0.0032 in |
| Bearing fitting tolerance | | 0.02 – 0.06 mm | 0.0008 – 0.0024 in |

Cylinder Block

| | | | |
|--|-----|----------------|------------------|
| Warping limit | | 0.05 mm | 0.0019 in |
| Cylinder bore | STD | 88.50–88.55 mm | 3.4842–3.4862 in |
| Cylinder bore wear limit | | 0.2 mm | 0.008 in |
| Difference of bore limit between cylinders | | 0.05 mm | 0.002 in |
| Taper and out-of-round | | 0.02 mm | 0.0008 in |

Crankshaft

| | | | |
|---|----------|--------------------|--------------------|
| Runout limit | | 0.1 mm | 0.0040 in |
| Crank journal taper and out-of-round limit | | 0.01 mm | 0.0004 in |
| Crankpin journal taper and out-of-round limit | | 0.01 mm | 0.0004 in |
| Thrust clearance | STD | 0.02 – 0.20 mm | 0.0008 – 0.0079 in |
| | Limit | 0.3 mm | 0.0118 in |
| Crankpin journal oil clearance | STD | 0.02 – 0.05 mm | 0.0008 – 0.0020 in |
| | Limit | 0.08 mm | 0.0032 |
| Bearing U/S | | 0.05, 0.25, 0.50 | |
| Journal diameter | STD | 52.976 – 53.000 mm | 2.0857 – 2.0866 in |
| | U/S 0.25 | 52.70 – 52.71 mm | 2.0749 – 2.0751 in |
| | U/S 0.50 | 52.45 – 52.46 mm | 2.0650 – 2.0654 in |
| Crank journal oil clearance | STD | 0.02 – 0.05 mm | 0.0008 – 0.0020 in |
| | Limit | 0.08 mm | 0.0032 in |
| Bearing U/S | | 0.05, 0.25, 0.50 | |
| Journal diameter | STD | 59.976 – 60.000 mm | 2.3613 – 2.3622 in |
| | U/S 0.25 | 59.70 – 59.71 mm | 2.3504 – 2.3508 in |
| | U/S 0.50 | 59.45 – 59.46 mm | 2.3406 – 2.3409 in |

Piston and Piston Ring

| | | | |
|--------------------------------------|-----------------------|------------------|--------------------|
| Piston outer diameter | STD | 88.44 – 88.49 mm | 3.4819 – 3.4839 in |
| | O/S | 0.50, 1.00 | |
| Cylinder to piston clearance | | 0.05 – 0.07 mm | 0.0020 – 0.0028 in |
| Piston pin installing temperature | | 100°C | 212°F |
| Piston ring end gap | Compression ring No.1 | 0.10 – 0.30 mm | 0.0039 – 0.0118 in |
| | Compression ring No.2 | 0.10 – 0.30 mm | 0.0039 – 0.0118 in |
| | Oil ring | 0.2 – 0.5 mm | 0.008 – 0.020 in |
| Piston ring to ring groove clearance | Comp. ring No.1 | 0.02 – 0.06 mm | 0.0008 – 0.0024 in |
| | Comp. ring No.2 | 0.02 – 0.06 mm | 0.0008 – 0.0024 in |

Connecting Rod and Bearing

| | | | |
|--------------------------|-------|------------------------------|--------------------|
| Big end thrust clearance | STD | 0.16 – 0.26 mm | 0.0063 – 0.0102 in |
| | Limit | 0.3 mm | 0.012 in |
| Bearing oil clearance | STD | 0.02 – 0.05 mm | 0.0008 – 0.0020 in |
| | Limit | 0.08 mm | 0.0031 in |
| Bearing U/S | | 0.05, 0.25, 0.50, 0.75, 1.00 | |
| Bushing oil clearance | STD | 0.005 – 0.014 mm | 0.00020 – 0.00055 |
| | Limit | 0.015 mm | 0.00059 in |

Flywheel

| | | |
|---------------|--------|----------|
| Run-out limit | 0.2 mm | 0.008 in |
|---------------|--------|----------|

LUBRICATING SYSTEM**Oil Pump**

| | | | |
|----------------|-------|----------------|--------------------|
| Tip clearance | STD | 0.10 – 0.15 mm | 0.0039 – 0.0059 in |
| | Limit | 0.2 mm | 0.008 in |
| Side clearance | STD | 0.03 – 0.07 mm | 0.0012 – 0.0028 in |
| | Limit | 0.15 mm | 0.0059 in |
| Body clearance | STD | 0.10 – 0.16 mm | 0.0039 – 0.0063 in |
| | Limit | 0.2 mm | 0.008 in |

COOLING SYSTEM**Water Pump**

| | | |
|-----------------------------|-------|-------|
| Bearing fitting temperature | 100°C | 212°F |
|-----------------------------|-------|-------|

Fluid Coupling

| | |
|-----------------------|----------|
| Silicon oil viscosity | 6000 cst |
| w/Tempered fan | 3000 cst |
| Capacity | 25 cc |
| w/Tempered fan | 35 cc |

Thermostat

| | | |
|---------------------------|------|---------|
| Valve opening temperature | | |
| Fully opens at | 88°C | 190°F |
| Valve opening travel | 8 mm | 0.31 in |
| only 18R-C | | |

Radiator

| | | | |
|-------------------------------|-------|------------------------|----------|
| Relief valve opening pressure | STD | 0.9 kg/cm ² | 12.8 psi |
| | Limit | 0.6 kg/cm ² | 8.5 psi |

FUEL SYSTEM**Carburetor (for South Africa)**

| | | | |
|---|--|--------------------|-----------|
| Float Level | Raised position | 5.0 mm | 0.197 in |
| | Lowered position | 1.0 mm | 0.040 in |
| Throttle Valve Fully opened angle (from bore) | | 90° | |
| Kick up | Secondary Throttle Valve to Body Clearance | 0.2 mm | 0.008 in |
| | Primary Throttle Opening Angle (from bore) | 64 – 90° | |
| Fast Idle (Clearance) | | 1.1 mm | 0.043 in |
| Unloader Angle (from bore) | | 47° | |
| Accelerating Pump Stroke | | 4.5 mm | 0.0173 in |
| Idle Mixture Adjusting Screw Preset Position | | Screw out 2½ turns | |
| Choke Valve Fully Closed Temperature | | below 25°C | 77°F |

Carburetor (except South Africa)

| | | | |
|---|-------------------------|-------------------|--------------------|
| Float Level | Raised position | 10.0 – 11.0 mm | 0.39 – 0.43 in |
| | Lowered position | 1.0 – 1.2 mm | 0.039 – 0.047 in |
| Throttle Valve Fully opened angle (from bore) | | 90° | |
| Kick up | Secondary Throttle | | |
| | Valve to Body Clearance | 0.1 – 0.3 mm | 0.004 – 0.012 in |
| Seco-touch | | 57 – 61° | |
| Fast Idle | | Automatic Choke | 0.81 mm (0.032 in) |
| First Throttle Valve to Body Clearance | | Manual Choke | 1.01 mm (0.039 in) |
| Unloader Angle (from bore) | | 50° | |
| Accelerating Pump Stroke | | 4.0 mm | 0.16 in |
| Idle Mixture Adjusting Screw Preset Position | | Screw out 3 turns | |
| Choke Valve Fully Closed Temperature | | Below 25°C | 77°F |
| Choke Breaker | | | |
| | Automatic Choke | 19° | |
| | Manual Choke | 16° | |

STARTING SYSTEM**Starter**

| | | | |
|-------------------------------------|--------|--------------------------|--------------------|
| No load characteristics | Ampere | Less than 50 A at 11.5 V | |
| | RPM | More than 5000 rpm | |
| Armature shaft to bushing clearance | STD | 0.1 – 0.14 mm | 0.0039 – 0.0055 in |
| | Limit | 0.2 mm | 0.008 in |
| Armature shaft thrust clearance | Limit | 0.8 mm | 0.032 in |
| Brush length | STD | 16 mm | 0.63 in |
| | Limit | 12 mm | 0.47 in |
| Commutator runout | STD | Less than 0.05 | 0.002 in |
| | Limit | 0.4 mm | 0.016 in |
| Commutator diameter | STD | 32.7 mm | 1.287 in |
| | Limit | 31 mm | 1.22 in |
| Mica depth | STD | 0.5 – 0.8 mm | 0.020 – 0.031 in |
| | Limit | 0.2 mm | 0.008 in |
| Pinion end to stop collar clearance | | 1.0 – 4.0 mm | 0.04 – 0.16 in |
| Moving stud length (Reference only) | | 34 mm | 1.34 in |

IGNITION SYSTEM**Distributor**

| | | |
|------------------------|----------------|------------------|
| Shaft thrust clearance | 0.15 – 0.50 mm | 0.006 – 0.020 in |
| Point gap | 0.45 mm | 0.018 in |
| Dwell angle | 50 – 54° | |
| Damping spring gap | 0.1 – 0.4 mm | 0.004 – 0.016 in |

Distributor (Cont'd)

| ADVANCE CHARACTERISTICS (PART NO. 19100-34044, 19100-36020) (Except 18R-C A/T) | | | |
|--|-------------|-------|---------------------------|
| Vacuum advance angle | mmHg | inHg | Dis. advance angle Degree |
| | 80 | 3.15 | Advance begins |
| | 120 | 4.72 | 2° |
| | 200 | 7.87 | 5° |
| | 300 | 11.81 | 8° |
| Governor advance angle | Distributor | rpm | Dis. advance angle Degree |
| | 600 | | Advance begins |
| | 1050 | | 5.5° |
| | 1600 | | 13.0° |

Ignition Coil

| | |
|--------------------------------|----------------------|
| Primary coil resistance | About 1.4 Ω |
| Secondary coil resistance | About 8.5 k Ω |
| External resistor resistance | 1.3 – 1.7 Ω |
| Insulation resistance at 500 V | Over 10 M Ω |

High Tension Cord

| | |
|-----------------------|-------------------------|
| End to end resistance | Less than 25 k Ω |
|-----------------------|-------------------------|

Spark Plug

| | | |
|------------|----------------------|----------|
| Heat Range | ND W20EPR (for ECE) | W20EP |
| | NGK BPR6ES (for ECE) | BP6ES |
| Plug gap | 0.8 mm | 0.031 in |

CHARGING SYSTEM**Alternator**

| | | | |
|-----------------------|-------|-------------|---------|
| Maximum output ampere | | 40A | |
| Rotor coil resistance | | 4.1 – 4.3 Ω | |
| Brush length | STD | 12.5 mm | 0.49 in |
| | Limit | 5.5 mm | 0.22 in |

Alternator Regulator

| | |
|--------------------------------------|---------------|
| Voltage regulator regulating voltage | 13.8 – 14.8 V |
|--------------------------------------|---------------|

18R-G ENGINE MAIN PART TIGHTENING TORQUE

| Tightening Part | Tightening Torque | |
|-------------------------------|-------------------|-------------|
| | kg-m | ft-lb |
| Cylinder head | 7.2 — 8.8 | 52.1 — 63.7 |
| Camshaft bearing cap | 1.7 — 2.3 | 12.3 — 16.6 |
| Camshaft timing gear | 7.0 — 8.0 | 50.6 — 57.9 |
| Camshaft drive gear | 6.0 — 7.0 | 43.4 — 50.6 |
| Manifold (Intake and Exhaust) | 1.0 — 1.6 | 7.2 — 11.6 |
| Crankshaft bearing cap | 10.0 — 11.0 | 72.3 — 79.6 |
| Connecting rod cap | 6.4 — 7.0 | 46.3 — 50.6 |
| Oil pan | 0.4 — 0.8 | 2.9 — 5.8 |
| Crankshaft pulley | 9.9 — 10.1 | 71.6 — 73.1 |
| Flywheel | 8.2 — 8.8 | 59.3 — 63.7 |
| Thermo vacuum switching valve | 3.0 — 4.0 | 21.7 — 28.9 |

18R-G ENGINE SERVICE SPECIFICATION**18R-G ENGINE TUNE-UP**

| | | | |
|--|-----------------------------|----------------------------------|----------------------|
| Drive belt tension at 10 kg (22 lb) | | | |
| | Fan — Alternator | 8 — 12 mm | 0.31 — 0.47 in |
| | A/C compressor — Crankshaft | 16 — 19 mm | 0.63 — 0.75 in |
| Battery specific gravity at 20°C (70°F) | | 1.25 — 1.27 | |
| Coolant capacity (W/Heater) | | 9.1 Liter | 9.6 US qt 8.0 Imp.qt |
| Engine oil capacity | Total | 4.7 Liter | 5.0 US qt 4.1 Imp.qt |
| | Crankcase | 4.2 Liter | 4.4 US qt 3.9 Imp.qt |
| Spark plug heat range | ND | W20EXR | |
| | NGK | BPR-6EZ | |
| Spark plug gap | | 0.9 — 1.0 mm | 0.035 — 0.039 in |
| Distributor | Dwell Angle | 50 — 54° | |
| | Point Gap | 0.45 mm | 0.081 in |
| Ignition timing | at Engine stop | 5° BTDC | |
| | Coolant 60°C below | 20° BTDC (Reference only) | |
| | Coolant 60°C above | 5° BTDC/1000 rpm | |
| Firing order | | 1 — 3 — 4 — 2 | |
| Valve clearance (Cold) | Intake | 0.26 — 0.32 mm | 0.010 — 0.013 in |
| | Exhaust | 0.31 — 0.36 mm | 0.012 — 0.015 in |
| Initial idle speed | | 1000 ± 50 rpm | |
| Manifold vacuum | at Idle Speed | 330 mm Hg | 13.00 in Hg |
| | Front and rear difference | below 10 mm Hg | 0.39 in Hg |
| Compression pressure | STD | 13.0 kg/cm ² | 184.6 psi |
| | Limit | 10.0 kg/cm ² | 142.0 psi |
| Difference of pressure between cylinders | | Less than 1.0 kg/cm ² | 14.2 psi |

18R-G ENGINE**Cylinder Head**

| | | | |
|-----------------------------|--------------------------|-----------------------|--------------------|
| Surface warpage limit | | 0.05 mm | 0.0019 in |
| Valve | Contacting surface angle | 45° | |
| | Contacting width | 1.2 – 1.6 mm | 0.047 – 0.063 in |
| | Refacing angle | 30° 45° 60° | |
| Valve lifter inner diameter | Black | 37.951 – 37.957 mm | 1.4941 – 1.4944 in |
| | Blue | 37.957 – 37.963 mm | 1.4944 – 1.4946 in |
| | Yellow | 37.963 – 37.969 mm | 1.4946 – 1.4948 in |
| | Red | 37.969 – 37.975 mm | 1.4948 – 1.4951 in |

Valve Guide Bushing

| | | | |
|-----------------------|----------|------------------|--------------------|
| Inner diameter | | 8.500 – 8.515 mm | 0.3346 – 0.3352 in |
| Outer diameter | STD | 14.02 – 14.04 mm | 0.5513 – 0.5528 in |
| | O/S 0.05 | 14.07 – 14.09 mm | 0.5548 – 0.5551 in |
| Replacing temperature | | 100°C | 212°F |

Valve

| | | | |
|----------------------------------|---------|------------------|--------------------|
| Valve overall length | Intake | 106.8 mm | 4.20 in |
| | Exhaust | 105.1 mm | 4.14 in |
| Valve head contacting face angle | | 45° | |
| Valve stem diameter | Intake | 8.465 – 8.480 mm | 0.3333 – 0.3338 in |
| | Exhaust | 8.460 – 8.475 mm | 0.3330 – 0.3337 in |
| Valve stem oil clearance | Intake | 0.02 – 0.05 mm | 0.0008 – 0.0020 in |
| | Exhaust | 0.03 – 0.06 mm | 0.0012 – 0.0024 in |
| Limit | Intake | 0.08 mm | 0.0032 in |
| | Exhaust | 0.10 mm | 0.0039 in |
| Valve head thickness limit | Intake | 0.5 mm | 0.02 in |
| | Exhaust | 0.6 mm | 0.024 in |

Valve Spring

| | | | |
|-------------------|-------|---------|----------|
| Free length | | 45.6 mm | 1.795 in |
| Installed length | | 39.0 mm | 1.535 in |
| Installed tension | STD | 35.0 kg | 77.2 lb |
| | Limit | 29.5 kg | 65.0 lb |
| Squareness limit | | 1.6 mm | 0.063 in |

Valve Lifter

| | | | |
|----------------|--------|--------------------|--------------------|
| Oil clearance | STD | 0.02 – 0.03 mm | 0.0008 – 0.0012 in |
| | Limit | 0.1 mm | 0.004 in |
| Outer diameter | Black | 37.925 – 37.931 mm | 1.4931 – 1.4933 in |
| | Blue | 37.931 – 37.937 mm | 1.4933 – 1.4936 in |
| | Yellow | 37.937 – 37.943 mm | 1.4936 – 1.4938 in |
| | Red | 37.943 – 37.949 mm | 1.4938 – 1.4941 in |

Camshaft

| | | | |
|---|-------|--------------------|--------------------|
| Bend limit | | 0.03 mm | 0.0012 in |
| Thrust clearance | STD | 0.15 – 0.35 mm | 0.0059 – 0.0138 in |
| | Limit | 0.4 mm | 0.0158 in |
| Journal oil clearance | STD | 0.05 – 0.09 mm | 0.0020 – 0.0035 in |
| | Limit | 0.15 mm | 0.0059 in |
| Journal diameter | STD | 31.934 – 31.950 mm | 1.2572 – 1.258 in |
| Cam height (Both intake and exhaust) | STD | 45.37 – 45.47 mm | 1.786 – 1.790 in |
| | Limit | 45.0 mm | 1.77 in |

Manifold

| | | |
|---|--------|-----------|
| Manifold surface warpage limit (Both intake and exhaust) | 0.1 mm | 0.0039 in |
|---|--------|-----------|

Timing Chain

| | | | |
|------------------|-----------------|----------|----------|
| Elongation limit | No.1 (at 5 kg) | 291.4 mm | 11.47 in |
| | No.2 (17 Links) | 147.0 mm | 5.79 in |

Timing Gear

| | | | |
|------------|-----------------------|----------|----------|
| Wear limit | Crankshaft gear | 60.0 mm | 2.362 in |
| | Pump drive shaft gear | 114.5 mm | 4.508 in |
| | Camshaft drive gear | 78.2 mm | 3.079 in |
| | Camshaft timing gear | 78.2 mm | 3.079 in |

Chain Tensioner and Vibration Damper

| | | | |
|------------|-------------------|---------|----------|
| Wear limit | No.1 tensioner | 11.5 mm | 0.453 in |
| | No.1 damper | 5.0 mm | 0.20 in |
| | No.2 damper | 5.5 mm | 0.22 in |
| | No.3 damper | 6.5 mm | 0.26 in |
| | Tensioner slipper | 7.5 mm | 0.30 in |

Pump Drive Shaft and Bearing

| | | | |
|---------------------------|-------|------------------|--------------------|
| Thrust clearance | STD | 0.06 – 0.13 mm | 0.0024 – 0.0051 in |
| | Limit | 0.3 mm | 0.012 in |
| Journal diameter | Front | 45.59 – 45.75 mm | 1.7949 – 1.8012 in |
| | Rear | 40.59 – 40.75 mm | 1.5980 – 1.6043 in |
| Oil clearance | STD | 0.03 – 0.07 mm | 0.0012 – 0.0028 in |
| | Limit | 0.08 mm | 0.0032 in |
| Bearing fitting tolerance | | 0.02 – 0.06 mm | 0.0008 – 0.0024 in |

Cylinder Block

| | | | |
|--|-----|------------------|------------------|
| Warpage limit | | 0.05 mm | 0.0019 in |
| Cylinder bore | STD | 88.50 – 88.55 mm | 3.484 – 3.486 in |
| Cylinder bore wear limit | | 0.2 mm | 0.008 in |
| Difference of bore limit between cylinders | | 0.05 mm | 0.002 in |
| Taper and out-of-round | | 0.02 mm | 0.0008 in |

Crankshaft

| | | | |
|---|----------|--------------------|--------------------|
| Runout limit | | 0.05 mm | 0.0020 in |
| Crank journal taper and out-of-round limit | | 0.01 mm | 0.0004 in |
| Crankpin journal taper and out-of-round limit | | 0.01 mm | 0.0004 in |
| Thrust clearance | STD | 0.02 – 0.20 mm | 0.0008 – 0.0079 in |
| | Limit | 0.3 mm | 0.0118 in |
| Crankpin journal oil clearance | STD | 0.02 – 0.05 mm | 0.0008 – 0.0020 in |
| | Limit | 0.08 mm | 0.0032 in |
| Bearing U/S | | 0.05, 0.25, 0.50 | |
| Journal diameter | STD | 52.976 – 53.000 mm | 2.0857 – 2.0866 in |
| | U/S 0.25 | 52.70 – 52.71 mm | 2.0749 – 2.0751 in |
| | U/S 0.50 | 52.45 – 52.46 mm | 2.0650 – 2.0654 in |
| Crank journal oil clearance | STD | 0.02 – 0.05 mm | 0.0008 – 0.0020 in |
| | Limit | 0.08 mm | 0.0032 in |
| Bearing U/S | | 0.05, 0.25, 0.50 | |
| Journal diameter | STD | 59.976 – 60.000 mm | 2.3613 – 2.3622 in |
| | U/S 0.25 | 59.70 – 59.71 mm | 2.3504 – 2.3508 in |
| | U/S 0.50 | 59.45 – 59.46 mm | 2.3406 – 2.3409 in |

Piston and Piston Ring

| | | | |
|--------------------------------------|-----------------------|------------------|--------------------|
| Piston outer diameter | STD | 88.44 – 88.49 mm | 3.4819 – 3.4839 in |
| | O/S | 0.50, 1.00 | |
| Cylinder to piston clearance | | 0.05 – 0.07 mm | 0.0020 – 0.0028 in |
| Piston pin installing temperature | | 100°C | 212°F |
| Piston ring end gap | Compression ring No.1 | 0.10 – 0.30 mm | 0.0039 – 0.0118 in |
| | Compression ring No.2 | 0.10 – 0.30 mm | 0.0039 – 0.0118 in |
| | Oil ring | 0.2 – 0.5 mm | 0.008 – 0.020 in |
| Piston ring to ring groove clearance | Comp. ring No.1 | 0.02 – 0.06 mm | 0.0008 – 0.0024 in |
| | Comp. ring No.2 | 0.02 – 0.06 mm | 0.0008 – 0.0024 in |

Connecting Rod and Bearing

| | | | |
|--------------------------|-------|------------------------|----------------------|
| Big end thrust clearance | STD | 0.16 – 0.26 mm | 0.0063 – 0.010 in |
| | Limit | 0.3 mm | 0.012 in |
| Bearing oil clearance | STD | 0.02 – 0.05 mm | 0.0008 – 0.0020 in |
| | Limit | 0.08 mm | 0.0032 in |
| Bearing U/S | | 0.25, 0.50, 0.75, 1.00 | |
| Bushing oil clearance | STD | 0.005 – 0.014 mm | 0.00020 – 0.00055 in |
| | Limit | 0.015 mm | 0.00059 in |

Flywheel

| | | |
|---------------|--------|----------|
| Run-out limit | 0.2 mm | 0.008 in |
|---------------|--------|----------|

LUBRICATING SYSTEM**Oil Pump**

| | | | |
|----------------|-------|----------------|--------------------|
| Tip clearance | STD | 0.10 – 0.15 mm | 0.0039 – 0.0059 in |
| | Limit | 0.2 mm | 0.008 in |
| Side clearance | STD | 0.03 – 0.07 mm | 0.0012 – 0.0028 in |
| | Limit | 0.15 mm | 0.0059 in |
| Body clearance | STD | 0.10 – 0.16 mm | 0.0039 – 0.0063 in |
| | Limit | 0.2 mm | 0.008 in |

COOLING SYSTEM**Water Pump**

| | | |
|-----------------------------|-------|-------|
| Bearing fitting temperature | 100°C | 212°F |
|-----------------------------|-------|-------|

Fluid Coupling

| | | |
|-----------------------|----------|--|
| Silicon oil viscosity | 3000 cst | |
| w/Tempered fan | | |
| Capacity | 35 cc | |
| w/Tempered fan | | |

Thermostat

| | | |
|---------------------------|---------------|-------------|
| Valve opening temperature | | |
| Starts to open at | 80.5 – 83.5°C | 177 – 182°F |
| Fully opens at | 95°C | 203°F |
| Valve opening travel | 8 mm | 0.31 in |

Radiator

| | | | |
|-------------------------------|-------|------------------------|----------|
| Relief valve opening pressure | STD | 0.9 kg/cm ² | 12.8 psi |
| | Limit | 0.6 kg/cm ² | 8.5 psi |

FUEL SYSTEM**Carburetor**

| | | |
|--|--------------------|----------------|
| Model | 40-PHH-4 | |
| Float adjusting screw one turn | | |
| Float level change | 1.8 mm | 0.07 in |
| Float level (Use SST) | 16 – 18 mm | 0.63 – 0.71 in |
| Accelerating pump | | |
| Discharging time | 0.8 – 1.1 second | |
| Idle mixture adjusting screw preset position | Screw out 1½ turns | |

STARTING SYSTEM**Starter**

| | | | |
|-------------------------------------|--------|------------------------|--------------------|
| No load characteristics | Ampere | Less than 50A at 11.5V | |
| | RPM | More than 5000 rpm | |
| Armature shaft to bushing clearance | STD | 0.1 – 0.14 mm | 0.0039 – 0.0055 in |
| | Limit | 0.2 mm | 0.008 in |
| Armature shaft thrust clearance | Limit | 0.8 mm | 0.032 in |
| | STD | 16 mm | 0.63 in |
| Brush length | Limit | 12 mm | 0.47 in |
| | STD | Less than 0.05 mm | 0.002 in |
| Commutator runout | Limit | 0.4 mm | 0.016 in |
| | STD | 32.7 mm | 1.287 in |
| Commutator diameter | Limit | 31 mm | 1.22 in |
| | STD | 0.5 – 0.8 mm | 0.020 – 0.031 in |
| Mica depth | Limit | 0.2 mm | 0.008 in |
| | STD | 1.0 – 4.0 mm | 0.04 – 0.16 in |
| Pinion end to stop collar clearance | | | |
| Moving stud length (Reference only) | | 34 mm | 1.34 in |

IGNITION SYSTEM**Distributor**

| | | | |
|--------------------------------|-------------|----------------|----------------------------|
| Shaft thrust clearance | | 0.15 – 0.50 mm | 0.006 – 0.020 in |
| Point gap | | 0.45 mm | 0.018 in |
| Dwell angle | | 50 – 54° | |
| ADVANCE CHARACTERISTICS | | | |
| Vacuum advance angle | mmHg | inHg | Dis. advance angle Degrees |
| | 45 | 1.77 | Advance begins |
| | 75 | 2.95 | 4.3° |
| | 105 | 4.13 | 7.5° |
| Governor advance angle | Distributor | rpm | Dis. advance angle Degree |
| | 600 | | Advance begins |
| | 1400 | | 14° |
| | 3000 | | 13.5° |

Ignition Coil

| | |
|-------------------------------|----------------------|
| Primary | About 1.4 Ω |
| Secondary coil resistance | About 8.5 k Ω |
| External resistor resistance | 1.3 – 1.7 Ω |
| Insulation resistance at 500V | Over 10 M Ω |

High Tension Cord

| | |
|-----------------------|-------------------------|
| End to end resistance | Less than 25 k Ω |
|-----------------------|-------------------------|

Spark Plug

| | |
|------------|------------------------------------|
| Heat Range | ND W20EXR |
| | NGK BPR-6EZ |
| Plug gap | 0.9 – 1.0 mm 0.035 – 0.039 in |

CHARGING SYSTEM**Alternator**

| | |
|-----------------------|----------------------|
| Maximum output ampere | 45A |
| Rotor coil resistance | 4.1 – 4.3 Ω |
| Brush length STD | 12.5 mm 0.49 in |
| Limit | 5.5 mm 0.22 in |

Alternator Regulator

| | |
|--------------------------------------|---------------|
| Voltage regulator regulating voltage | 13.8 – 14.8 V |
|--------------------------------------|---------------|

MEMO

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Prepared

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Haruhi Center
Haruhi-mura, Nishikasugai-gun
Aichi Pref., Japan

Printing—March, 1977

No. 98196

Printed in Japan

